U.S. Department of Transportation

Federal Aviation Administration

Interface Control Document

ATCBI-5 BOS RMS FOR THE ARSR-4 SYSTEM

June 3, 1994

INTERFACE CONTROL DOCUMENT

APPROVAL SIGNATURE PAGE

ATCBI-5 BOS RMS FOR THE ARSR-4 SYSTEM

APPROVAL SIGNATURES
PARTICIPANT NAME DATE
CONTRACT A
CONTRACT B
PROJECT A (Project Manager)
PROJECT B (Project Manager)

REVISION RECORD

REVISION LETTER	DESCRIPTION	DATE	ENTERED BY

EFFECTIVITY	
LOCATION	DATE

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1.0 INTRODUCTION

1.1 Scope. This Interface Control Document (ICD) provides the design characteristics for an interface between the ATCBI-5 Remote Monitoring Subsystem (RMS) for the ARSR-4 and the Maintenance Processor Subsystem (MPS). This ICD satisfies the interface design requirements contained in IRD xxxxx, titled "Interface Requirements Document National ATCBI-4 RMS", dated May 29, 1989.

The ATCBI-5 RMS shall provide the capability to automate and remotely control the periodic tasks of equipment performance monitoring, reporting of site status, fault isolation, diagnostic testing, and control of remote ATCBI-5 facility. The ATCBI-5 RMS shall communicate with a centrally located Maintenance Processor Subsystem (MPS) to collect, record, analyze, and control the data flow for each individual ATCBI-5 remote facility.

The ATCBI-5 will interface with the MPS using a Synchronous Data Link Control (SDLC) interface. Characters transmitted across this interface shall be either ASCII or numerical values. All numeric values representing an ATCBI-5 parameter shall be coded as either a 16-bit or 32-bit binary number with the Most Significant Bit (MSB) being the sign bit. The transmission speed for this interface is 2400 baud.

1.2 Purpose. This ICD is a reference tool for programmers working on the ATCBI-5 RMS project. It defines the electrical, mechanical and data link control that will be used in the ATCBI-5 RMS. The ATCBI-5 RMS will also provide the interface to the MPS for the same environmental monitoring package as is currently used with the ATCBI-5 Beacon-Only Site (BOS) RMS.

Section 1.0 provides a general introduction to the ATCBI-5 RMS, Section 2.0 provides a list of both government and non-government applicable documents. Section 3.0 provides a detailed description of the interface characteristics needed for the ATCBI-5 RMS.

The National Airspace System (NAS) document for the ATCBI-5 RMS between MPS to RMS, NAS-MD-790, dated June 10, 1986, has been used to develop this ATCBI-5 RMS. This excludes the following options:

a. Paragraph 3.5.3, "Busy Status Message." Due to the multi-tasking of the RMX operating system, the RMS will never be too busy to reply to an MPS Message.

b. Paragraph 3.7.7, "Password Change Command." There is no RMS password needed within the RMS, as security is in the MPS.

c. Paragraph 3.7.8, "Data Base Download Command." There will be no data base down load capabilities for changing thresholds or programs.

1.3 Style and Convention. The style and conventions used throughout this document are standard government types. This includes the use of acronyms, abbreviations, and contractions.

1.3.1 Number Base Labeling. The base of a number used within this document is the one which is the most applicable. All numbers with a base other than decimal shall be labeled with the correct base. Decimal numbers are not labeled and are understood to be decimal by default. The labeling convention used is to enclose the base in parentheses after the number, for example:

01001011 (B) => Binary
747 (O) => Octal
2F (H) => Hexadecimal
1234 (Decimal) or preferred 1234

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this ICD to the extent specified herein. Unless otherwise specified, the version of the document defined shall be used for all development effort associated with this ICD.

2.1 Government Documents.

2.1.1 Federal Aviation Administration (FAA) Documents.

2.1.1.1 Specifications.

a. FAA-G-1210d, Provisioning Technical Documentation.

b. FAA-G-2100, Requirements for Equipment.

c. NAS-SS-1000, VOL 1 & VOL 5.

2.1.1.2 Standards.

a. FAA-STD-005D, Preparation of Specification Documents.

b. FAA-STD-016, Quality Control System Requirements.

c. FAA-STD-018, Computer Software Quality Program Requirements.

d. FAA-STD-021, Configuration Management (Contractor Requirements).

2.1.1.3 Orders.

a. FA Order 1830.2, February 1978, Policy for Use of Telecommunications Data Transfer Standards.

2.1.1.4 Others.

a. NAS-MD-790, June 10, 1986, Remote Maintenance Monitoring System Interface Control Document for Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrators.

b. NAS-MD-792, June 1984, Operational Requirements for the Remote Maintenance Monitoring System (RMMS).

c. NAS-MD-793, February 28, 1986, Remote Maintenance Monitoring System Functional Requirements for the Remote Monitoring Subsystem (RMS)

2.1.2 Department Of Defense (DOD) Documents.

2.1.2.1 Specifications.

2.1.2.2 Standards.

a. DOD-STD-2167, June 4, 1985, Defense System Software Development.

b. MIL-STD-483A, June 4, 1985, Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs.

c. MIL-STD-490, June 4, 1985, Specification Practices.

2.1.2.3 Federal Information Processing Standards Publication (FIPS PUB) Series Documents.

a. FIPS PUB 20, Guideline for Describing Information Interchange Format.

b. FIPS PUB 24, Flow Chart Symbols and Their Usage in Information Processing (Software and Documentation).

2.2 Commercial Documents.

a. Intel iRMX 86 Operating System Programmers Reference Manual.

b. Intel Software Handbook.

c. The "C" Programming Language by Kernighan & Ritchie, 1978, Prentice-Hall Inc.

d. C Programming Guidelines by Thomas Plum, 1984, Prentice-Hall Inc.

e. American National Standards Institute (ANSI) X3.1-1976, Synchronous Signaling Rates Between Data Terminal and Data Communication Equipment (FIPS Pub. 22-1, FED STD 1013).

f. ANSI X3.4-1977, The American National Standard Code for Information Interchange (FIPS Pub. 1).

g. ANSI X3.15-1976, Bit Sequencing of the American National Standard Code for Information Interchange in Serial-by-Bit Data Transmission (FIPS Publ. 16-1, FED. STD. 1010).

h. ANSI X3.16-1976, Character Structure and Character Parity Sense for Serial-by- Bit Data Communication in the American National Standard Code for Information Interchange (FIPS Pub. 17-1, FED. STD. 1011).

i. ANSI X3.24-1968, Signal Quality at Interface Between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial Data Transmission.

j. ANSI 88X3.28-1976, Procedures for the Use of the Communication Control Characters of the American National Standard Code for Information Interchange in Specified Data Communication Links.

k. ANSI X3.36-1975, Synchronous High Speed Data Signaling Rates Between Data Terminal Equipment and Data Communication Equipment.

l. ANSI X3.66-1979, American National Standard for Advanced Data Communication Control Procedures (ADCCP) (FIPS Publ. 71, FED. STD. 1003A).

m. Electronic Industries Association (EIA) Standard RS-232C-1969, General Purpose Interface Between Data Terminal Equipment and Data Circuit Communication Equipment Employing Serial Binary Data Interchange.

n. EIA Standard RS-269B-1976, Synchronous Signaling Rates for Data Transmission.

p. EIA Standard RS-334, Signal Quality at Interface Between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial Transmission.

q. EIA Standard RS-449-1977, General Purpose 37-Position and 9-Position Interface For Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

2.3 Source of Documentation. All referenced documentation may be obtained from the originating organization. Each originating organization address is listed in the following paragraphs for the user's convenience.

2.3.1 FAA Documents. Copies of the FAA specifications, standards, and publications may be obtained from the Contracting Officer, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591. Requests should clearly identify the desired material by number and date, and state the intended use of the material.

2.3.2 Military and Federal Documents. Single copies of unclassified military and federal specifications, standards, and publications may be obtained by writing the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120; or by calling (215) 697-3321 Monday through Friday, 8:00 a.m. to 4:30 p.m. E.S.T.

2.3.3 Consultative Committee for International Telegraph and Telephone (CCITT) Documents. Copies of CCITT standards may be obtained from the International Telecommunications Union, Place des Nations, CH-1211, Geneva 20, Switzerland.

2.3.4 ANSI and Institute of Standards Office (ISO) Documents. Copies of ANSI and ISO standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

2.3.5 EIA Documents. Copies of EIA standards may be obtained from the Electronic Industries Association, 2001 I Street, N.W., Washington, DC.,
20006.

2.3.6 NFPA Documents. Copies of NFPA standards may be obtained from the NFPA, Battermatch Park, Quincy, MA 02260.

2.3.7 Federal Communication Commission (FCC) Documents. Copies of FCC codes may be obtained from the U.S. Government Printing Office, Washington, DC 20402.

3.0 INTERFACE CHARACTERISTICS

3.1 General Design Characteristics. The ATCBI RMS-to-MPS interface provides a means of monitoring and controlling the ATCBI system from a remote site or sites using the commercial telephone network. The interface consists of the hardware to connect the RMS computer at the ATCBI site to a modem via an RS-232C interface. An addressing scheme is to be provided to allow the MPS to uniquely address the ATCBI RMS. The addressing scheme is constructed to make the network transparent to the terminal equipment (see paragraph 3.2.2.1). The MPS acts as the master station in the network and polls the ATCBI RMSs as required. Messages are sent in fixed format in response to the polls. The physical transfer of data shall be the BIT-oriented data link procedures for synchronous communication defined in NAS-MD-790.

3.2 Functional Characteristics. The following paragraphs define the hardware and software requirements of the MPS to ATCBI RMS interface. Included in this section are the means of sending data, establishing contact, and data formats.

3.2.1 Application Layer. The various ATCBI RMSs in a RMMS network are connected to the MPS using 2400 baud synchronous modems. The details of the hardware are defined in paragraph 3.2.8. Once physical contact is established, messages are sent using a code transparent data link procedure for synchronous communications as described in NAS-MD-790. The data link procedure includes retry and contact establishment procedures. The RMS is assigned an address. This address is used to route data through the network. At the RMS the network address components are transparent, as explained below. The MPS is the master station and receives and sends the entire (address) routing information.

3.2.2 Addressing. The addressing scheme used between the MPS and RMS is designed to uniquely identify the specific source or destination of information in the network. Within the ATCBI RMS, common or related information is grouped into logical-units (LU) for ease of processing. The lowest level destination address is identified as a logical-unit. Any point below the logical-unit shall be identified as a data point. RMS addresses shall be identified by single characters within the range hex '20 to hex 'FD', with the least significant bit always equal to 1. For the ATCBI-5, the site address is '81'.

3.2.2.1 Addressing Scheme. The address for any destination shall consist of a variable length header to identify multiple levels of the network. Figure 3-1 shows a generalized structure for this address header.

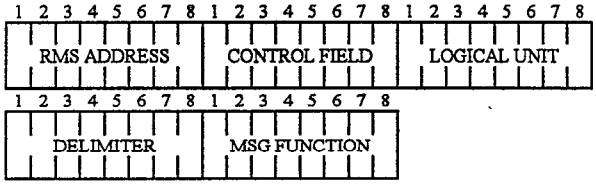


Figure 3-1. ADDRESSING FORMAT

3.2.2.1.1 Logical Units. The ATCBI facility has been determined to have multiple groups of like data points, status, or conditions; each group is defined as a separate logical unit. A logical unit is defined as hardware,

functions, or conditions that have functional and/or physical commonality. Logical unit partitioning is the distribution of all reportable data points, status, and conditions into these related groups.

3.2.2.1.1.1 **Data Point Definition**. A data point is an equipment parameter within a logical unit.

3.2.2.1.1.2 **Logical Unit Addressing**. The ATCBI system uses logical units. Each logical unit represents a physical location and group of functions in the system. Not all logical units exist at all sites because not all sites contain all possible system components. The addresses of all possible logical units in an ATCBI site are listed in Table 3-1.

TABLE 3-1 LOGICAL UNIT ASSIGNMENT

LU (Hex)	Common Function/Equipment
20	RMS Master logical unit
21	Terminal Communications (Not used)
22	Environmental
23	RMS/MPS Communications
24	ATCBI-5 Channel 1
25	ATCBI-5 Channel 2
26	Interim Common Digitizer (CD-2) Channel A
27	Interim CD-2 Channel B
28	Common Digitizer (CD-1)
29	Azimuth Data Unit (ADU)
2A	ATCBI Switching Unit (ASU)
2D	Local MDT

3.2.2.1.1.2.1 **RMS Master Logical Unit LU 20**. The RMS Master LU 20 contains those data points associated with the RMS unit itself and to data pertaining to the ATCBI as a whole. Subsequent LUs are used to group data associated with more specific functions.

3.2.2.1.1.2.2 **Terminal Communications LU 21**. This LU defines the association between a specific terminal device with a data point id. Terminal messages up to 504 bytes may be sent to a MDT or the RMS's MDT. Messages up to 72 bytes may be sent to a display channel for presentation on the operational display. Messages to a display station that are longer than 72 bytes will be truncated. The RMS will use the data point id in Terminal Messages to the MPS to indicate the source or input device used to input the message. The RMS recognizes a global broadcast data point id of 4FH. Terminal communication protocol will be provided in it's own ICD.

3.2.2.1.1.2.3 **Environmental LU 22**. The Environmental LU 22 includes all the data points associated with the facility in which the ATCBI-5 is installed. Not all data points apply depending on the site configuration.

3.2.2.1.1.2.4 **RMS/MPS Communication LU 23**. The RMS/MPS Communication Logical Unit shall contain those data points related to the RMS-to-MPS interface.

3.2.2.1.1.2.5 **ATCBI Channel 1 LU 24**. This Logical Unit contains all the status and performance data associated with ATCBI Channel 1.

3.2.2.1.1.2.6 **ATCBI Channel 2 LU 25**. This Logical Unit contains all the status and performance data associated with ATCBI Channel 2.

3.2.2.1.1.2.7 **Interim CD-2 Channel A LU 26**. This Logical Unit contains all the status and performance data associated with CD-2 Channel A.

3.2.2.1.1.2.8 **Interim CD-2 Channel B LU 27**. This Logical Unit contains all the status and performance data associated with CD-2 Channel B.

3.2.2.1.1.2.9 **Common Digitizer (CD-1) LU 28**. This Logical Unit contains all the status and performance data associated with CD-1.

3.2.2.1.1.2.10 **Azimuth Data Unit (ADU) LU 29**. This Logical Unit contains all the status and performance data associated with Azimuth Data Unit.

3.2.2.1.1.2.11 **ATCBI Switching Unit (ASU) LU 2A**. This Logical Unit contains all the status and performance data associated with ATCBI Switching Unit

3.2.2.1.1.2.12 **Local Maintenance Data Terminal (MDT) LU 2D**. This Logical Unit contains all the equipment specific commands, variables, status and performance data associated with the Local MDT. This LU is not used by the MPS.

3.2.2.1.1.3 **Data Point Addressing**. Each item of data within a logical unit is designated a "Data Point," and is addressed by its "data point ID". The data point ID is a single character in the range hex '20' to hex 'FF'. The data point IDs are assigned in accordance with the data point tables (See Appendix A).

3.2.2.2 **Polling**. The MPS is the network master, all other devices in the network are accessed by being polled by the MPS. Three types of polls are defined:

1. Continuous Poll
2. Scheduled Poll
3. Specific Poll

By definition, both the Continuous and Scheduled Polls are directed to all logical-units while the Specific Poll is directed to a specific Logical Unit of the RMS.

3.2.2.2.1 **Continuous Poll**. The supervisory command and response procedure employed by the MPS to retrieve messages is defined as a continuous Poll. The MPS shall initiate this procedure continually at intervals determined by site adaptation to allow transfer of messages to the MPS. On receipt of a valid Continuous Poll, the addressed RMS shall, if it has any messages to send, initiate a message transfer in accordance with the priorities of paragraph 3.2.3.5.

3.2.2.2.2 Scheduled Poll. The supervisory command and response procedure employed by the MPS to retrieve all monitored data is defined as a Scheduled Poll. The MPS shall initiate this procedure upon operator request or at intervals determined by site adaptation to cause the transfer of site data. On receipt of a valid Scheduled Poll, the addressed RMS shall initiate a message transfer of all continuously monitored performance data via Site Data Reports (SDR). These logical units shall only be transmitted during scheduled polls if no alarms or status changes present. In order to accomplish this, the RMS may interleave pending priority messages with the SDR to meet the requirements of paragraph 3.2.3.5.

The specific responses by an RMS to a valid Scheduled Poll are as follows:

a. If any priority messages are pending, the RMS shall respond by sending the priority messages in accordance with paragraph 3.2.3.5.1. If alarm conditions, or state changes are detected (prior to termination of the scheduled polling procedure), the RMS shall queue and transmit the new priority message(s) during the poll.

b. When there are no priority messages waiting for transfer, the RMS shall respond by sending the SDR messages, as applicable, for all RMS logical units. The RMS shall terminate the scheduled polling sequence only after all SDRs have been forward or as otherwise directed by the MPS

3.2.2.2.3 Specific Poll. The supervisory command and response procedure employed by the MPS to retrieve current performance data from a single, specific logical unit of an RMS is defined as a Specific Poll. The MPS shall initiate this procedure on operator command to provide the requested data. On receipt of a valid Specific Poll, the addressed RMS shall initiate a message transfer of the continuously monitored performance data via a Site Data Report (SDR) for the addressed logical unit only. In addition, the RMS shall send pending priority messages with the SDR response to meet the requirements of paragraph 3.2.3.5.1.

The specific response(s) by an RMS to a valid Specific Poll are as follows:

a. If any priority messages are pending, the RMS shall respond by sending the priority messages in accordance with paragraph 3.2.3.5.1. If alarm conditions, or state changes are detected between message block transmissions (prior to termination of the specific polling procedure), the RMS shall queue and transmit the new priority message(s) during that poll response sequence.

b. When there are no priority messages waiting for transfer, the RMS shall respond by sending only the SDR message for the addressed logical unit. The RMS shall terminate the specific polling sequence only after the logical unit SDR message or appropriate response has been forwarded or as directed by the MPS.

3.2.2.3 Poll Responses. The ATCBI RMS shall respond to polls in one of several ways. If there are any priority messages they will be sent. In response to a scheduled or specific poll if no priority messages are pending the RMS sends a Site Data Report (SDR) for the Logical Units address by the poll.

3.2.3 Presentation Layer. Data is transferred from the RMS to MPS and from the MPS to RMS in variable length fixed format messages.

3.2.3.1 Character Set. Data is sent as ASCII characters, least significant bit (LSB) first. The data within the message is always transferred left to right, with the left most bit being the low order bit.

3.2.3.2 Numeric Data. All numeric values shall be transmitted as 16-bit or 32-bit binary integers. Upon reception, the integer will first be converted to decimal format by the MPS on the basis that the LSB has a value of unity. The decimal point will then be placed in accordance with the structure of the data as defined in Appendix A. Thus if the data is to contain one decimal place and the value of the data is 600.82, the transmission shall be the binary equivalent of 6008. If the data point in this example were to contain two decimal places, then the binary equivalent of 60082 is to be transmitted. The most-significant-bit (MSB) of the binary value is the sign-bit with 0 representing a positive number. Negative numbers are represented in two's complement notation with the sign-bit set to 1.

3.2.3.3 Status Data. Non-numeric data (ie., status/condition information) shall be coded into single ASCII characters. Information coded into each character shall pertain to a single data point or condition.

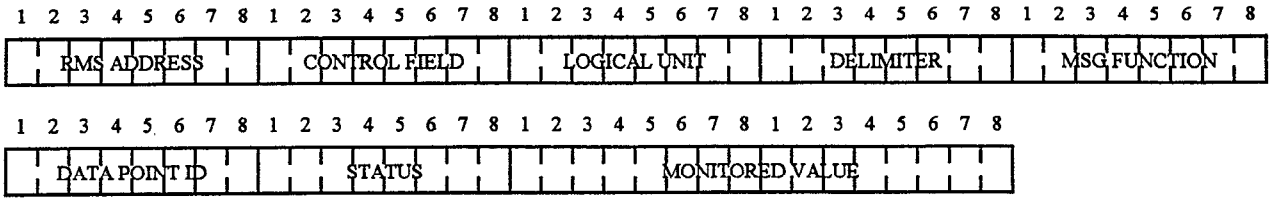
3.2.3.3.1 Availability Status. Not used.

3.2.3.3.2 Condition Status. To report the status of data points that are logical (i.e., on/off, high/low, etc.), or have numeric values, the following condition status coding shall be used:

ASCII Code	Functional Description
A/a	Monitored data point or condition is normal (normal could be either on or off).
B/b	Not being monitored (i.e., data point not applicable nor available to the RMS).
C/c	The monitored data point is in the hard alarm state and the data point value is above the high threshold value. In this situation, if the data point value is beyond the monitoring range of the RMS, the data point value shall be set to 0.
D/d	The monitored data point is in the hard alarm state and the data point value is below the low threshold value. In this situation, if the data point value is beyond the monitoring range of the RMS, the data point value shall be set to 0.
E/e	The monitored data point is in the soft alarm state and the data point value is above the high threshold value. In this situation, if the data point value is beyond the monitoring range of the RMS, the data point value shall be set to 0.
F/f	The monitored data point is in the soft alarm state and the data point value is below the low threshold value. In this situation, if the data point value is beyond the monitoring range of the RMS, the data point value shall be set to 0.

NOTE: Upper case characters shall be used for data point values transmitted as 16-bit integers.

3.2.3.4 Overall General Message Format. Messages sent to the MPS shall be a composite of the address, message identifier, and formatted as shown in the following formats.



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	32 to 255	See table 3-2
DATA POINT ID	8	32 to 255	See paragraph 3.2.2.1.1.1
STATUS	8		See paragraphs 3.2.3.3.2
VALUE	16	-32,768 to 32,767	If the monitored value is not applicable, it is set to 0

FIGURE 3-2. OVERALL GENERAL MESSAGE FORMAT

3.2.3.4.1 Message Prefix. The information field of all message exchanges between the RMS and MPS shall include a prefix group consisting of a variable length address header followed by two characters as defined below.

a. The first character after the logical unit address shall always be the delimiter hex 00.

b. The second character shall denote the function and format of the message text and shall be within the range hex 20 through hex FF. The valid message function codes are shown in Table 3-2.

TABLE 3-2 MESSAGE FUNCTION CODES

MESSAGE FUNCTION CODE	DEFINITION
A	Hard alarm message
a	Soft alarm message
B	Return to normal message
C	State change message
D	Data base download request
E	Command error message
G	Site data report
H	Command message
I	Terminal message
@	Poll indicator see Para 3.2.7.4.1 through 3.2.7.4.3
*	Terminal Concentrator

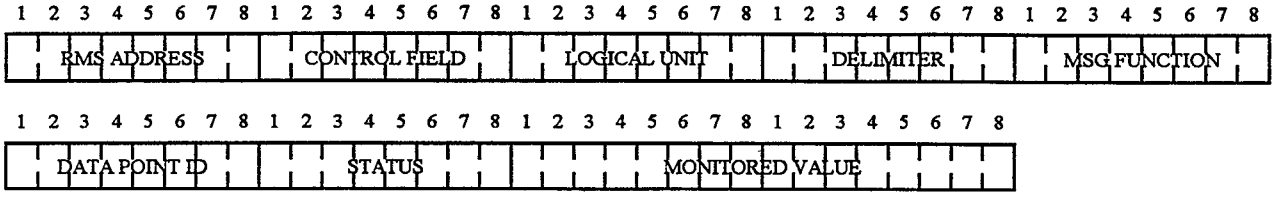
3.2.3.4.2 Data. The type of format of the data is dependent on the message types and data items. The detailed data items are listed in Appendix A.

3.2.3.5 Message Types. A number of types of messages are defined to transfer data within the RMMS. These fall into four classes:

1. Priority Messages
2. Non-response Messages
3. Other Non-solicited Messages
4. Normal Messages

3.2.3.5.1 Priority Messages. The following messages are defined as Priority Messages. These messages are sent in response to a poll per paragraph 3.2.2.2.

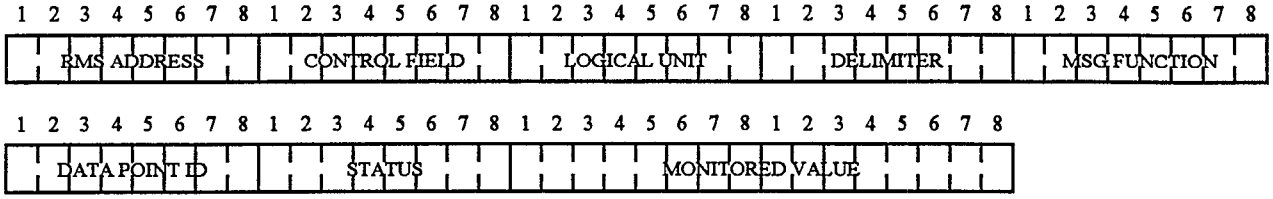
3.2.3.5.1.1 Alarm Message. An Alarm message shall be generated as soon as the RMS determines a monitored data point, status, or condition is sensed as being in an alarmed state. Alarm messages have the highest priority and shall be processed and transmitted to the MPS on the next polling request, as they are detected, on a first-in, first-out basis. Alarm messages shall be fixed field with a message function code of either "A" to designate "Hard" alarms or "a" to designate "Soft" alarms in the prefix. Message length shall always be four bytes with three fields, data point ID, condition status, and numeric value, respectively, following the message prefix (see Figure 3-3). Multiple alarm messages for a single logical unit may be transmitted in a single information field by appending the data point ID, condition status code, and monitored value for each data point in alarm. A value of 0 is placed in the numeric value field when data point corresponds to a parameter were a numeric value is not applicable.



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	A, a	Alarm message
DATA POINT ID	8	hex '20'-'FF'	
STATUS	8	C through F	See paragraph 3.2.3.3.2
VALUE	16	-32,768 to 32,767	If the monitored value is not applicable, it is set to 0

FIGURE 3-3. ALARM MESSAGE FORMAT

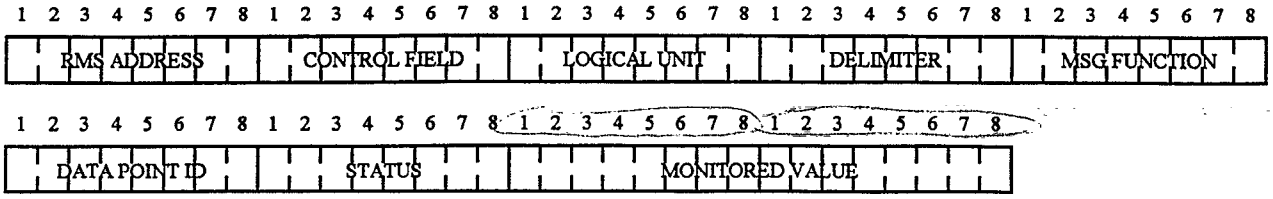
3.2.3.5.1.2 Return-to-Normal (RTN). The RTN message shall be used to convey that a previously reported alarm condition is no longer in the alarmed state. This message shall be a fixed field with a message function code of "B" in the prefix. Message length shall always be four bytes with three fields, data points ID, status condition, and numeric value, respectively, following the prefix field (see Figure 3-4). This message, has the same priority as alarm messages and shall be sent whenever a previously reported alarm condition is no longer in the alarmed or non-normal state. Numeric data is contained in the third field after the message function. Multiple RTN messages for a single logical unit may be transmitted in a single information field. Numeric data is contained in the third field after the Message Function.



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	B	Alarm message
DATA POINT ID	8	hex '20'-'FF'	
STATUS	8	C through F	See paragraph 3.2.3.3.2
VALUE	16	-32,768 to 32,767	If the monitored value is not applicable, it is set to 0

FIGURE 3-4. RETURN-TO-NORMAL MESSAGE FORMAT

3.2.3.5.1.3 State Change Message. A State Change message shall be a fixed field message as shown in Figure 3-5 having a function code of "C". It is used to convey a change in the operational status at the RMS site that has been specifically directed by the MPS, the RMS, or by an on-site operator. Message length shall be four bytes. A State Change message shall be generated as soon as the RMS determines a monitored data point, status, or condition that is not monitored for alarm generation is sensed as being in a new state. State Change messages have the second highest priority and in the absence of higher priority messages shall be processed and transmitted to the MPS on the next polling request, as the are detected, on a first-in, first-out basis. Multiple State Change messages may be transmitted in a single information field for a single logical unit.



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	C	Alarm message
DATA POINT ID	8	hex '20'-'FF'	
STATUS	8	C through F	See paragraph 3.2.3.3.2
VALUE	16	-32,768 to 32,767	If the monitored value is not applicable, it is set to 0

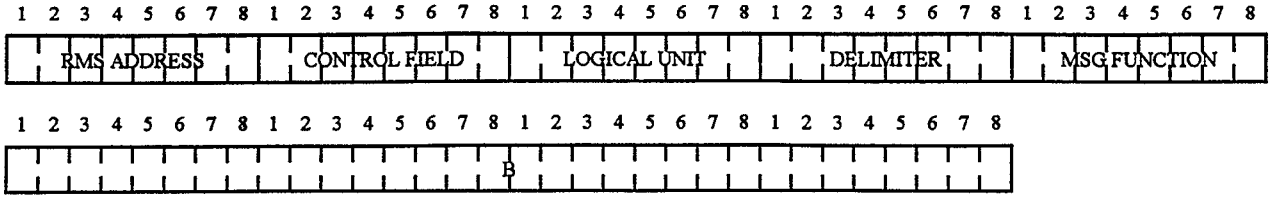
FIGURE 3-5. STATE CHANGE MESSAGE FORMAT

3.2.3.5.1.4 Terminal Message. Terminal messages shall be assigned to the terminal logical unit and shall have third priority for transmission. In the absence of higher priority messages, they shall be transmitted on the next polling sequence. The message function code "I" shall be used to identify terminal messages, and the data point ID shall identify individual terminals within the terminal logical unit. Terminal messages may be originated at either the primary or the secondary station.

3.2.3.5.1.5 Site History. History data can be obtained from the MPS's database or through the local MDT via the RMS internal history files which reside only in the RMS and can retain up to 4000 commands and 4000 alarm and/or state change messages. The RMS internal history files are for local use only and are not remoted to the MPS.

3.2.3.5.2 Other Unsolicited Messages. Several messages are defined as non-priority messages, but which are sent as a fourth priority level in response to a poll.

3.2.3.5.2.1 Command Error. The Command Error message shall be a variable length message with a message function code of "E" in the prefix. This message is assigned to the RMS Master logical unit and used to notify the MPS it has received a message properly at the link level but the message cannot be interpreted due either to format or data content errors. The received message shall be inserted in its entirety, excluding link level control characters, after the prefix (see Figure 3-6).



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	E	Command error
B	Variable		Command error

FIGURE 3-6. COMMAND ERROR MESSAGE FORMAT

3.2.3.5.2.2 Busy Message. Due to the RMX operating system and the design of the software, the RMS is never too busy to not respond immediately to a valid MPS poll.

3.2.3.5.3 Normal Response Messages. The normal response to a specific poll shall be the specified logical unit site data report preceded by or followed by current alarms or state changes. The normal response to a scheduled poll shall be site data reports for all logical units in the RMS proceeded by, followed by or interleaved by current alarms or state changes. The normal response to a continuous poll shall be all current alarms and state changes.

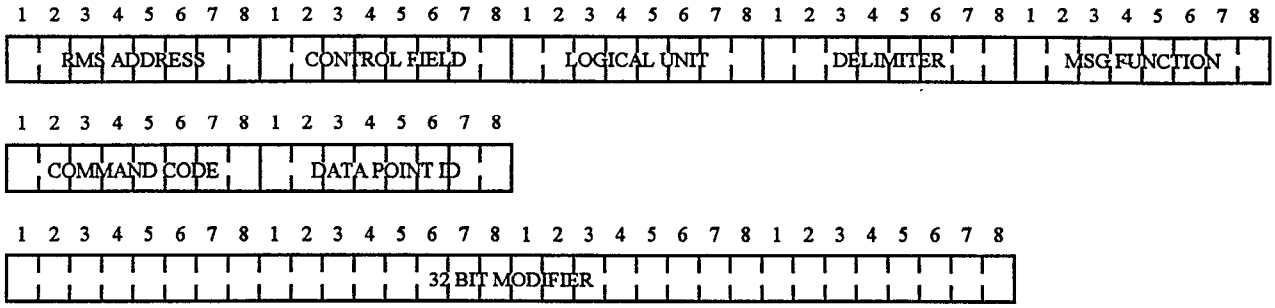
3.2.3.5.3.1 Site Data Report (SDR). The Site Data Report is a fixed field message with a message function code of "G" or "g". This message transfers all data points within a logical unit. The SDR is sent in three parts; A prefix, a group of status characters, and data point values. The prefix is the address and message function code "G" as defined in paragraph 3.2.3.4.1 and the LU, followed by groups of state changes and data point values. (Note "g" is used only for non-operating logical units.)

3.2.3.5.3.1.1 Logical Unit Status. The Logical Unit availability status is not applicable to the ATCBI RMS as there are no non-operating logical units. The logical unit is assigned to a specific hardware equipment, Channel 1, Channel 2, etc. and is always available to monitor the equipment status weather on or off. The RMS makes no decisions as to the quality of the readings. The certifying technician makes that decision. All readings are presented to him as is. When the RMS first comes up a condition status of "B" is written into the data base. When the RMS updates the database with current data the "B" is overwritten with the current status. The MPS handles the "B" as a data point not monitored.

3.2.3.5.3.1.2 Data Point Status. The SDR is organized such that the data points are grouped in order of their logical unit. Since there are no gaps between data points, a contiguous stream of data will be generated. The first group of data following the message function code are data points with condition status only. After this group are data points with a status and 16-bit numeric value. Appendix A contains all the LUs defined for the ATCBI and shows the ordering of the data points. A state change message is generated whenever a change of state occurs for on of these parameters.

3.2.3.6 Commands. The MPS can issue commands to the ATCBI for purposes of control and maintenance. Commands that impact the operation characteristics of the ATCBI are accepted only if control of the equipment is transferred to the MPS. Other commands that are used to obtain information or to control tests that are non-interfering are accepted at any time. Upon reception of a valid command, the RMS responds to the MPS with a state change message or SDR.

The list of commands that may be issued from the MPS are enclosed in Appendix A, page A-1. Certain commands require one or more parameters in addition to the command code. Measurement descriptions and valid values are also shown in Appendix A, pages A-2 to A-6. The basic command format is shown in Figure 3-7. All commands are addressed to the RMS Logical Unit the command is associated with.



FIELD	NO. BITS	RANGE OF VALUE (DECIMAL)	ADDITIONAL INFO
ADDRESS/CONTROL FIELD/LU	8 each	-	See Paragraph 3.2.2 Includes logical unit
DELIMITER	8	00	
MSG FUNCTION	8	H	Command code
COMMAND CODE	8	See Appendix A for a complete list of command codes	
DATA POINT ID	8	hex '20'-'FF'	
32 BIT MODIFIER	32		

FIGURE 3-7. COMMAND FORMAT

3.2.4 Session Layer. This section of the ICD defines the data items, summarizes establishment and termination of communications and defines the encryption techniques used in the network.

3.2.4.1 Encryption. MPS-to-RMS communication shall use encrypted data, if required, in accordance with FIPS Publication 46 dated January 15, 1977. Message structure and content described herein shall be before encryption. Encryption is not an ATCBI RMS function.

3.2.4.2 Session Establishment and Termination. Communication between the MPS and RMS are made over standard data lines using a 2400 baud synchronous modems.

3.2.5 Transport Layer. This section defines the recovery procedures used in the bit-oriented data link procedures discussed in section 3.2.6. This section also describes the procedures used to recover from errors, and in the event of loss of communications.

3.2.5.1 Loss of Data Lines. If the data lines are lost, the MPS will continue to try to reestablish contact with the RMS. The RMS will display on the local MDT that communications has been lost with the MPS. If the RMS output buffers overflow, the data is discarded. Upon reestablishing communication with the MPS, the RMS advises the MPS through a data base down load that the data in the MPS database may be obsolete and if the MPS wishes, it should request a schedule poll to update it's database with current site data.

3.2.5.2 Recovery Procedures. The general definition and framework of the recovery procedures shall be in accordance with NAS-MD-790 pages 46-48. The approach to be used in obtaining such compliance is set forth in this section. In areas where this document does not provide guidance to the contrary, the aforementioned standard shall apply.

3.2.6 Network Layer. The network which connects the RMS at the ATCBI site to the MPS consists of telephone lines and possibly concentrators. Figure 3-8 is a block diagram of a generalized network.

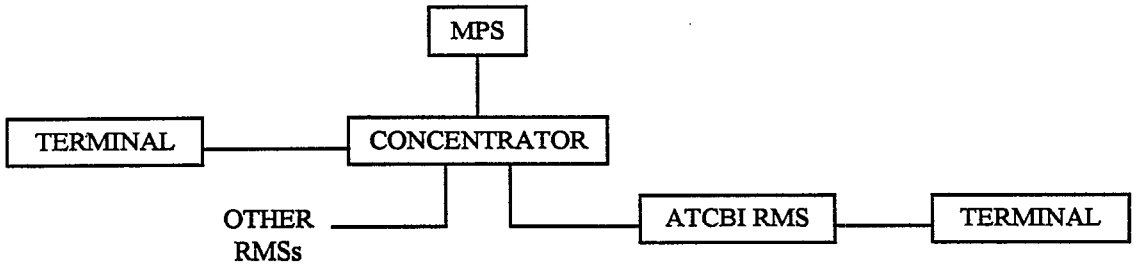


FIGURE 3-8. GENERALIZED NETWORK

3.2.6.1 MPS Functions in the Network. The MPS is designated as the primary station and shall control the sequence of data interchange and recovery operations within the data link, including:

a. Initialization
b. Organization of the data flow
c. Retransmission control
d. All recovery functions at the data link level

3.2.6.2 RMS Functions in the Network. Each RMS is designated as a separately addressed secondary station and performs communication functions as directed by the control station, including:

a. Accepting data (commands and messages) from the control station

b. Sending data, status or other RMS related information to the control station

c. Returning positive and negative responses to the control station

3.2.7 BIT-Oriented Data Link Procedures for Synchronous Communication. The bit-oriented data link protocol shall comply with the ANSI BSR X3.66 standards for class UN, options 1(b), and 2 with the following exceptions:

a. Extended Length Frame Check Sequence (FCS) Fields (ADCCP 3.5). Only the normal 16-bit FCS will be supported.

b. Asynchronous Response Opportunity (ARO) Detection (ADCCP 6.2.2) will not be supported.

c. Asynchronous Response (ARM) and Asynchronous Balanced (ABM) Modes will not be supported. In particular, the following commands are excluded:

(1) SARM
(2) SABM
(3) SARME
(4) SABME
(5) XID

3.2.7.1 Operational Summary. The bit-oriented data link control procedures shall be employed when operating in synchronous mode. The basic operation shall be set as Normal Response Mode (NRM). Application level data link requirements, such as data field formatting and message text contents are specified in section 3.2.2. Two-way alternate (TWA) data transfer is implemented under control of the MPS.

3.2.7.2 Frame structure. All transmissions shall be in frames and each frame shall conform to the following structure with bit sequencing in accordance with paragraph 3.11 of ANSI X3.66 and d. below. The RMS operates in the Two Way Alternate (TWA) mode satellite delays etc.

FLAG	LINK	CONTROL	INFORMATION FIELD				FCS	FLAG
F	ADDRESS	FIELD	LU	MSG	DATA POINT	STATUS		

FIGURE 3-9. FRAME STRUCTURE

a. Flag is an 8-bit sequence (01111110) which delimits the beginning and end of each frame. The flag is used for frame synchronization.

b. Link Address - Secondary station address (paragraph 3.2.2)

c. Control contains a command or response and may contain sequence numbers in accordance with ANSI BSR X3.66 and is described in paragraph 3.2.7.2.1.

d. The Information field (I field) shall contain the message text specified in paragraph 3.2.2 and 3.2.3. The link address is not repeated in the message prefix. The length of the information field may be a variable number of bytes but shall not exceed 512 bytes excluding the "0" bits added to achieve code independence. The order of bit transmission for data contained within the information field shall be transmitted low-order bit first. In order to allow for intermediate concentrators in the network, the ATCBI RMS shall not generate an information field greater than 504 bytes. This limits the number of intermediate concentrators to eight.

e. A maximum of seven frames may be transmitted before frame acknowledgment.

f. The Frame Check Sequence (FCS) shall be included in each frame for the purpose of error detection. The Cyclic Redundancy Check (CCITT polynomial described in ANSI X3.66, section 12) sequence shall be used on all frame contents, excluding flag sequences and all "0" bits inserted and deleted for achieving code independence.

3.2.7.2.1 Control Field. The Control field shall be used by the MPS to instruct the address RMS to perform a specific link level operation. It is also used by the RMS to respond to the MPS. There are three basic formats defined for the Control field which are used to perform information transfer, basic supervisory control functions, and special control functions. These are as follows:

CONTROL FIELD BITS	1	2	3	4	5	6	7	8
INFORMATION TRANSFER FORMAT (I)	0	N(S)			P/F	N(R)		
SUPERVISORY FORMAT (S)	1	0	S	S	P/F	N(R)		
UNNUMBERED FORMAT (U)	1	1	M	M	P/F	M	M	M

Where:

N(S)= The sequence number of the frame; assigned by sending station (I frames only).

N(R)= Expected sequence number of the next received frame. Set by sending station to indicate it has correctly received all prior I frames.

P/F= Poll (P) for the Command Frames and Final (F) used for Response Frames. The P bit is used to:

P = USED BY THE MPS

1. Provide a transmit opportunity to the secondary station (RMS) for the transfer of I frames.

2. Obtain a response from the secondary station (RMS) to a specific command.

The F bit is used to: USED BY THE RMS

1. Indicate the last frame of this response opportunity by the secondary station (RMS).

2. Indicate to the primary (MPS) the next expected frame number (N(R)) in the frame where F = 1. If this number is less than expected, the primary will initiate check point recovery. Reference section 8.2.1 of ANSI X3.66.

S= Supervisory function bits

M= Modifier function bits

FIGURE 3-10. CONTROL FIELD

3.2.7.2.1.1 Information Transfer Frame Format (I). The I format shall be used to perform an information or command transfer. The function of N(S), N(R), and P/F are independent. For example, each I frame has an N(S) sequence number. The N(R) sequence number may or may not acknowledge additional I frames by the receiving station.

3.2.7.2.1.2 **Supervisory Frame Format (S).** The S format shall be used to perform link supervisory control functions such as acknowledging I frames, requesting retransmission of I frames, and as an indication of temporary link level interruptions in receiving I and U frames. The functions of N(R) and P/F are independent. The definitions and control field assignments for the supervisory frame shall be as shown in Table 3-3.

TABLE 3-3 SUPERVISORY FORMAT CONTROL FIELD ASSIGNMENTS

RESPONSE	DEFINITION	1 2 3 4 5 6 7 8
RECEIVER READY (RR)	RR is used by a station to: (1) indicate it is ready to receive an I frame and (2) acknowledge I frames numbered up to and including N(R)-1. The primary station may use the RR command with the P bit set to "1" to solicit responses from (continuous poll) a secondary station. An RR frame is one way to report the end of a station busy condition.	1 0 0 0 P/F N(R)
RECEIVER NOT READY (RNR)	RNR is used by a station to indicate a busy condition, i.e., the temporary inability to accept additional I frames. Refer to paragraphs 7.2.2 and 8.1 in ANSI X3.66 as modified by options specified in 3.2.7 of this document.	1 0 1 0 P/F N(R)
REJECT (REJ)	REJ is used by station to request retransmission of I frame starting with the frame numbered N(R).	1 0 0 1 P/F N(R)

NOTE: Bit 1 (least significant bit) is transmitted first.

3.2.7.2.1.3 Unnumbered Frame Format (U). The U format contains no sequence numbers and is used to perform special link control functions. The definitions and control field assignments for the U commands and responses shall be as shown in Tables 3-4 and 3- 5, respectively.

TABLE 3-4 UNNUMBERED COMMANDS CONTROL FIELD ASSIGNMENTS

RESPONSE	DEFINITION	1 2 3 4 5 6 7 8
SET NORMAL RESPONSE (SNRM)	SNRM is used by the MPS to place the addressed RMS in the NRM. Upon acceptance of this command the secondary station send and receiver variables are set to zero. Previously transmitted I frames that are unacknowledged when this command is actioned remain unacknowledged.	1 1 0 0 P 0 0 1
DISCONNECT (DISC)	DISC is used by the MPS to perform a logical disconnect when it wishes to suspend operation with the RMS.*	1 1 0 0 P 0 1 0

*Appropriate RMS response to a DISC is an UA. If the RMS was previously disconnected, a DM response shall be returned.

NOTE: Bit 1 (least significant bit) is transmitted first.

TABLE 3-5 UNNUMBERED RESPONSES CONTROL FIELD ASSIGNMENTS

RESPONSE	DEFINITION	1 2 3 4 5 6 7 8
UNNUMBERED ACKNOWLEDGMENT (UA)	The UA response is used by RMS to report the receipt and acceptance of the SNRM, and DISC commands. The UA will not be used to report the end of a station busy condition.	1 1 0 0 F 1 1 0
REQUEST DISCONNECT (RD)	The RD response is used by RMS to report to the MPS that it wishes to be placed in disconnect mode.	1 1 0 0 F 0 1 0
DISCONNECT MODE (DM)	The DM response is used by RMS to request the MPS to issue a mode-setting command, or if sent in response to a mode-setting command to inform MPS that the RMS is still in the NDM and cannot execute the mode-setting command.	1 1 1 1 F 0 0 0
FRAME REJECT (FRMR)	The FRMR response is used by RMS to report an error condition not recoverable by retransmission of the same frame. For example: 1. Control is invalid or not implemented. 2. Information field exceeds maximum length. 3. Invalid N(R) number from MPS. This information is conveyed in the Basic Information Fields as defined ANSI X3.66 with four zero bits of pad.	1 1 1 0 F 0 0 1

Note: Bit 1 (least significant bit) is transmitted first.

3.2.7.2.2 Link Address. The link address, or the secondary station address as stated in paragraph 3.2.2.2.b, is the address that is inserted in the link address field by the station that originates a frame. The address is the destination address when inserted by the primary station and the originating address when inserted by the secondary station. The link address shall always have the least significant bit set to 1 as required by FIPS Publication 71.

3.2.7.3 Code Transparency. To achieve code transparency (prevent false flag recognition) within a frame, the sending station shall insert a binary 0 bit following five contiguous binary 1 bits anywhere in the data stream between the opening and closing flags of the frame. On receiving a binary 0 bit followed by five contiguous binary

1 bits, the receiving station shall inspect the next bit. If is a binary 0, the five previous binary 1 bits are passed on as data and the zero bit is deleted. If it is a binary 1, the receiving station shall inspect the next bit (seventh). If it is a binary 0, the pattern is a flag sequence; if it is a binary 1, the pattern is an abort sequence.

3.2.7.4 Establishment and Response. The MPS is designated as the Primary station for the data link and shall poll or select the RMS on the data link. Message responses and data field formats are specified in Section 3.2.2. If the RMS has a message to send when polled, it shall send the message using I format. Intermediate frames shall have the final bit set to "0" and the last frame shall have it set to "1". If no further message are pending or seven I frames are outstanding, the RMS shall respond with an RR frame with P/F bit set to "1".

(Receive Ready)

If the RMS receives a non-valid supervisory sequence (any error) the RMS shall not respond. If the MPS receives an invalid response or no response from an RMS, the Retry Procedures shall apply. The criteria for a non-valid supervisory sequence is any one of the following:

a. Invalid RMS address.
b. Invalid Flag at the start or end of the supervisory sequence.

Figures 3-11 through 3-24 illustrate the exchange procedures between MPS and RMS.

3.2.7.4.1 Continuous Poll. The Frame structure for the Continuous Poll is shown below.

CHARACTER	FUNCTION	INTERPRETATION
01111110	Flag	Start frame
xxxxxxxx	Link address (RMS ADD)	See 3.2.2
10001N(R)	Control Field RR frame with P=1	
FCS(1st Byte)	Frame Check Sequence	
FCS(2d Byte)	Frame Check Sequence	
01111110	Flag	End Frame

3.2.7.4.2 Scheduled and Specific Poll. The frame structure for the scheduled poll is shown below.

CHARACTER	FUNCTION	INTERPRETATION
01111110	Flag	Start frame
xxxxxxxx	Link address (RMS ADD)	See 3.2.2
ON(S)1N(R)	Control Field	I frame with P=1
11111111	Logical Unit	Global Logical Unit for Scheduled SDR's
or		
xxxxxxxx	Logical Unit	Specific Logical Unit Address
00000000	Delimiter	See 3.2.2
00000010	Poll Indicator	Poll Message Function
FCS(1st Byte)	Frame Check Sequence	
FCS(2d Byte)	Frame Check Sequence	
01111110	Flag	End Frame

3.2.7.4.3 Message Transfer Selection. The command and response procedures to transfer messages to and from the RMS are as shown in the following examples using the information (I) frame as specified in 3.2.7.2.

The master station controls all communication on the data lines. The RMS will communicate on the data line only when responding to commands or interrogations from the MPS. The address of the ATCBI RMS is HEX '81'. The address of the slave station is a prefix to all SDLC frames sent by both the master and slave stations. The code immediately after the address is the Control Field. The RMS's implementation of SDLC uses the following control fields:

TABLE 3-6 CONTROL FIELDS FROM THE MPS TO THE RMS

MNEMONIC	HEX CODE	DEFINITION
SNRM	93	Set Normal Response Mode
RR	11	Continuous Poll -- Acknowledge through Frame 7 Ready for Frame 0
	31	Continuous Poll -- Acknowledge through Frame 0 Ready for Frame 1
	51	Continuous Poll -- Acknowledge through Frame 1 Ready for Frame 2
	71	Continuous Poll -- Acknowledge through Frame 2 Ready for Frame 3
	91	Continuous Poll -- Acknowledge through Frame 3 Ready for Frame 4
	B1	Continuous Poll -- Acknowledge through Frame 4 Ready for Frame 5
	D1	Continuous Poll -- Acknowledge through Frame 5 Ready for Frame 6
	F1	Continuous Poll -- Acknowledge through Frame 6 Ready for Frame 7

TABLE 3-7 CONTROL FIELDS FROM THE RMS TO THE MPS

MNEMONIC	HEX CODE	DEFINITION
DM	1F	Disconnect Mode -- RMS needs SNRM from MPS
UA	73	Unnumbered Acknowledge -- RMS response to SNRM
FRMR	97	Frame Reject -- Sequence Error
RR	11	Receiver Ready -- Acknowledge through Frame 7 Ready for Frame 0
	31	Receiver Ready -- Acknowledge through Frame 0 Ready for Frame 1
	51	Receiver Ready -- Acknowledge through Frame 1 Ready for Frame 2
	71	Receiver Ready -- Acknowledge through Frame 2 Ready for Frame 3
	91	Receiver Ready -- Acknowledge through Frame 3 Ready for Frame 4
	B1	Receiver Ready -- Acknowledge through Frame 4 Ready for Frame 5
	D1	Receiver Ready -- Acknowledge through Frame 5 Ready for Frame 6
	F1	Receiver Ready -- Acknowledge through Frame 6 Ready for Frame 7

3.2.7.4.3.1 Disconnect Mode. When the RMS is first turned on, or the RMS CPU is reset, the RMS is in the Disconnect Mode. All frames from the MPS (except SNRM) will be answered by the RMS with the DM frame as shown below. Figure 3-11 through 3-24 are pictorial representations of the two way communication as seen on a HP-4951A protocol analyzer.

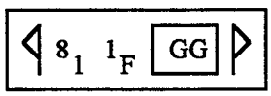


FIGURE 3-11. DISCONNECT MODE

The GG represents the protocol analyzer's recognition of a good 16-bit SDLC frame check sequence. When there is a flashing BB, this means the protocol analyzer did not recognize the received message as a good 16-bit SDLC frame; data lines with noise on it will cause this. The SDLC in the RMS will ignore all messages with bad frame checking.

The ⌜ and ⌝ are the framing brackets representing SDLC flag characters.

3.2.7.4.3.2 Set Normal Response Mode. A Set Normal Response Mode frame (SNRM) must be sent to the RMS before communication can begin. This frame causes the RMS to initialize its SDLC software, which takes the RMS out of Disconnect Mode. After an SNRM, the frame counters of both the RMS and the MPS will be reset to zero. The 81 HEX code is the address of the RMS, and the 93 HEX code is the SNRM code.

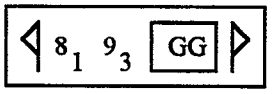


FIGURE 3-12. SET NORMAL RESPONSE

3.2.7.4.3.3 Unnumbered Acknowledgment. When the MPS sends the RMS a Set Normal Response Mode, the RMS replies with an Unnumbered Acknowledge (UA). This frame is illustrated below.

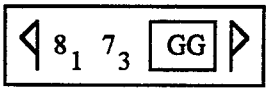


FIGURE 3-13. UNNUMBERED ACKNOWLEDGMENT

3.2.7.4.3.4 Receiver Ready. A typical Receiver Ready or Continuous Poll SDLC frame is shown below as it would be viewed on a protocol analyzer.

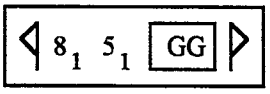


FIGURE 3-14. SDLC RECEIVER READY/CONTINUOUS POLL FRAME

3.2.7.4.3.5 Receiver Ready/Continuous Poll. The 81 is the address of the RMS, while the 51 HEX code is the SDLC code for a Receiver Ready/Continuous Poll. If this frame was transmitted by the MPS, it would be a Continuous Poll acknowledging information frames sent by the RMS through frame 1, and requesting frame 2. If it was sent by the RMS, it would be a Receiver Ready acknowledging information frames sent by the MPS through frame 1, and signaling readiness to receive frame 2. The bit arrangement of the receive frame counter (Nr) within the control field on an RR frame is shown below.

Nr2	Nr1	Nr0	1
0	1	0	1

5

0	0	0	1
0	0	0	1

1

FIGURE 3-15. RECEIVER READY/CONTINUOUS POLL CONTROL FIELD

3.2.7.4.3.6 SDLC information frame.

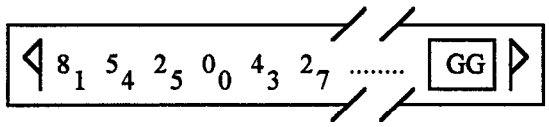


FIGURE 3-16. SDLC INFORMATION FRAME

The first HEX code is 81, which is the RMS address. The second HEX code is determined by the current RMS and MPS frame counters. Nr is the number of the next frame to be received, and Ns is the number of the next frame to be transmitted. Up to seven Information Frames may be sent consecutively by a master or slave station. The P/F (POLL/FINAL) bit signals whether or not this information frame is the last one to be transmitted in the current exchange. In an Information Frame sent by the RMS, this signals the MPS that the RMS is ready for another frame. If the P/F bit is set in an Information Frame sent by the MPS, the MPS expects the RMS to respond with a Receiver Ready or more Information Frames. As seen below, the Information Frame control field of 54 corresponds to an Nr of 2 and an Ns of 2. Since the P/F bit is 1, this is the last Information Frame to be sent in this exchange.

3.2.7.4.3.7 Information Frame Control Field.

Nr2	Nr1	Nr0	P/F
0	1	0	1

5

Ns2	Ns1	Ns0	0
0	1	0	0

4

FIGURE 3-17. INFORMATION FRAME CONTROL FIELD

If, during the course of conversation between the MPS and the RMS, the RMS has sent, for an example, five information frames and the MPS detects a bad SDLC message packet (resulting from noise on the line or just a bad line), then, it replies to the RMS a Continuous Poll Frame containing the number of the next frame it expects to receive. This would be the last good frame it received plus one. When this number is less then the number of frames the RMS knows it has sent the MPS, then RMS will retransmit the frames from that number to the last frame again.

3.2.7.4.3.8 Frame Reject. If at any point the MPS acknowledges a frame which was never sent by the RMS, the RMS will reply with an FRMR (Frame Reject). This will cause the MPS to send an SNRM to reset the frame counters. See below.

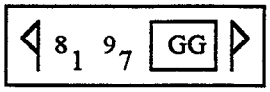


FIGURE 3-18. FRAME REJECT

3.2.7.4.3.9 RMS Start Up Sequence. Below is a typical example of the first few frames of communication between the MPS and the RMS after first booting up the RMS.

After the RMS is reset it will be in the "Disconnect Mode", and all queries from the MPS will be answered with DM ('81 1F') on the analyzer. The following diagrams represent the view as displayed on the protocol analyzer.

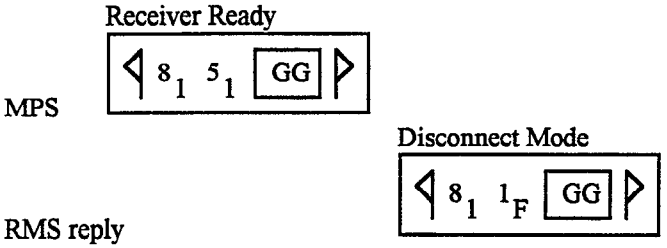


FIGURE 3-19. RMS RESET

3.2.7.4.3.10 Loss of Communication. In order to get the attention of the RMS after a loss in communication and initialize the SDLC software in the RMS, the MPS will send SNRM ('81 93'). The RMS will answer this with UA ('81 73').

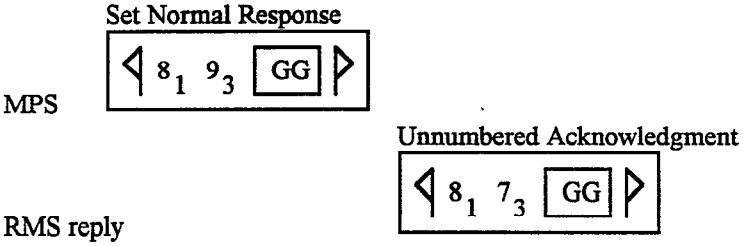


FIGURE 3-20. SDLC INITIALIZATION SEQUENCE

3.2.7.4.3.11 Continuous Poll with no Data. The MPS will then send an RR or (what is called a Continuous Poll), ('81?1') to ask the RMS if it has any data. If the RMS has no data to return to the Center, it will respond with another RR.

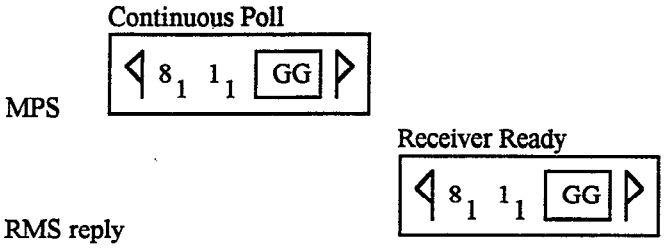


FIGURE 3-21. SDLC CONTINUOUS POLL, NO DATA SEQUENCE

3.2.7.4.3.12 Continuous Poll with Single Frame Data. The MPS will then send an RR or (what is called a Continuous Poll), ('81?1') to ask the RMS if it has any data. If the RMS has data to return to the Center, it will respond with the data.

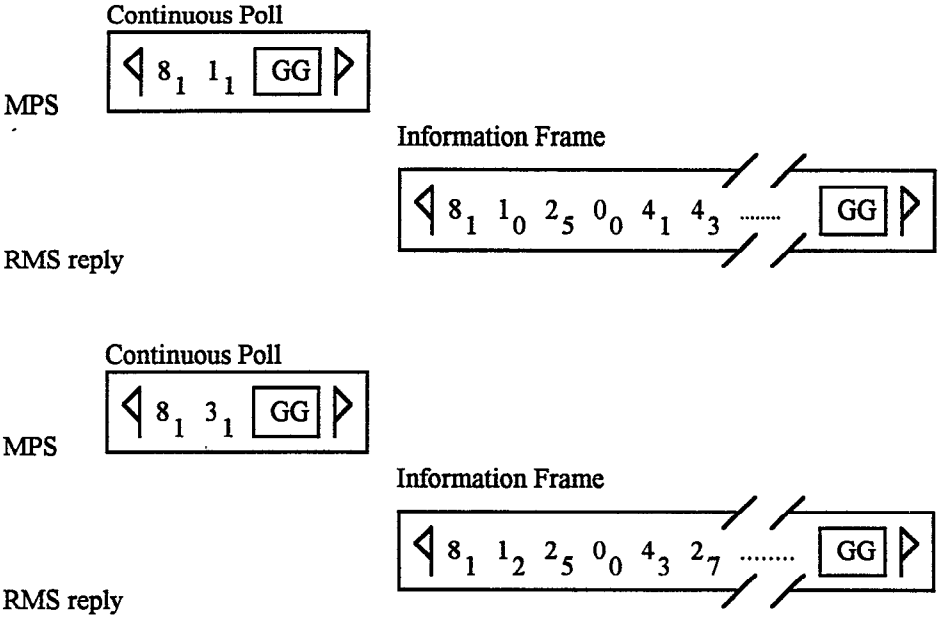


FIGURE 3-22. SDLC CONTINUOUS POLL WITH INFORMATION.

3.2.7.4.3.13 Continuous Poll with Multi-frame Data. When there is more data than will fill a single frame, the RMS can send up to seven frames. The following example is for three frames with the proper MPS response.

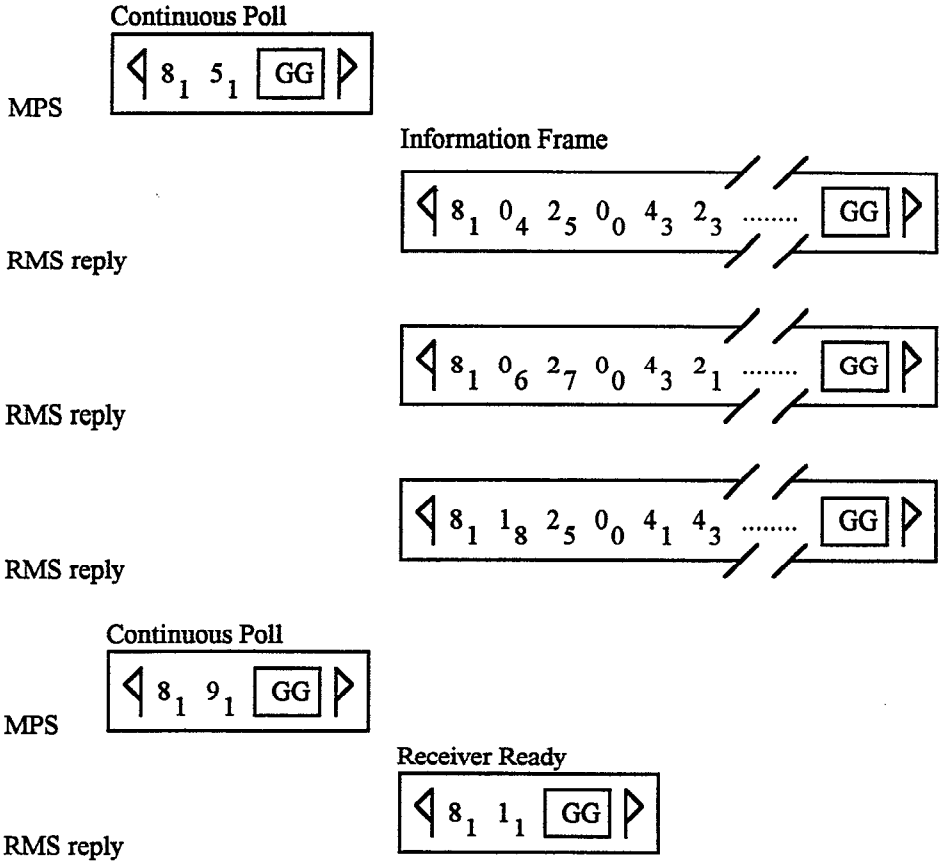


FIGURE 3-23. CONTINUOUS POLL WITH THREE INFORMATION FRAMES & ACKNOWLEDGMENT.

3.2.7.4.3.14 Communication Problems. When the MPS is unable to communicate with the RMS (Does not receive at least a receiver ready from a Continuous Poll), the MPS sends a Set Normal Response Mode and expects to see in return an Unnumbered Acknowledge. If the transmit data line from the MPS to the RMS has deteriorated to the point where the modem has dropped off the RMS channel, then a Protocol Analyzer at the radar site would see NO DATA coming to the site. If the transmit data line from the RMS to the MPS is bad and has been dropped off by the modem, then a Protocol Analyzer at the radar site would see a never ending string of Set Normal Response followed by an Unnumbered Acknowledge.

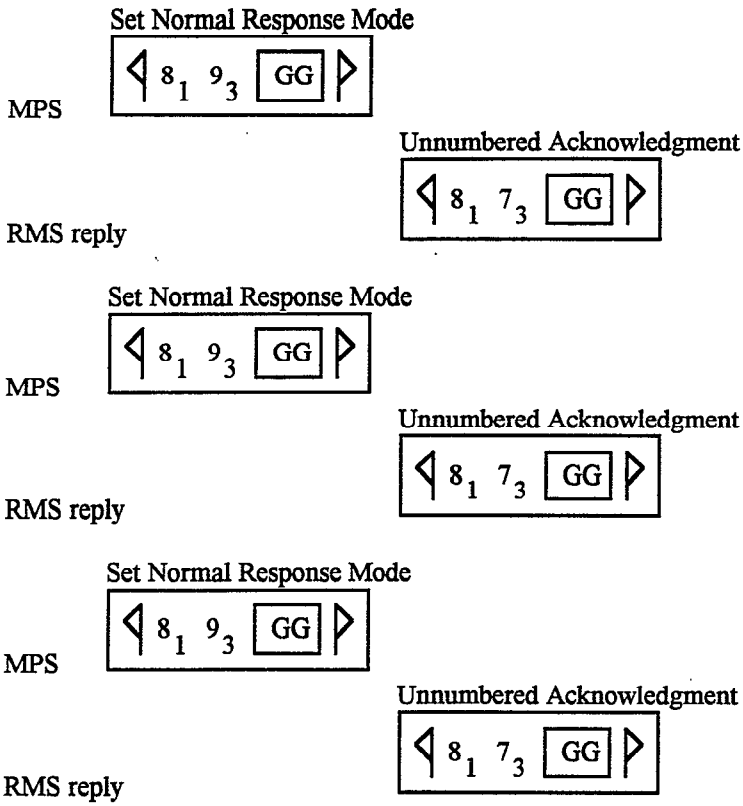


FIGURE 3-24. RMS TO MPS ONE-WAY COMMUNICATION FAILURE

3.2.8 Physical Layer. The physical interface between the RMS of an ATCBI site and the MPS shall be at a minimum of 2400 baud synchronous data.

3.2.8.1 RMS to Modem Interface. The interface between the RMS and the modem shall meet the requirements of EIA STD-RS-232C. The connector on the RMS shall be a 25-pin D-type female configured as Data Terminal Equipment (DTE). Interface "D" of RS-232C shall be used; Table 3.8 illustrates the connections used in the interface.

TABLE 3-8 RS-232C INTERFACE

PIN	NAME	USED IN RMS	TO DTE	TO DCE	FUNCTION	(CCITT)	CIRCUIT (EIA)
1	FG	*	*	*	Frame Ground	101	(AA)
2	TD	*		*	Transmitted Data	103	(BA)
3	RD	*	*		Received Data	104	(BB)
4	RTS	*		*	Request-To-Send	105	(CA)
5	CTS	*	*		Clear-To-Send	106	(CB)
6	DSR	*	*		Data Set Ready	107	(CC)
7	SG	*			Signal Ground	102	(AB)
8	DCD	*	*		Data Carrier Detect	109	(CF)
9					Positive DC Test Voltage		
10					Negative DC Test Voltage		
11					Unassigned		
12	DCD (S)		*		Secondary DCD	122	(SCF)
13	CTS (S)		*		Secondary CTS	121	(SCB)
14	TD (S)			*	Secondary TD	118	(SBA)
15	TC	*	*		Transmitter Clock	114	(DB)
16	RD (S)		*		Secondary RD	119	(SBB)
17	RC	*	*		Receiver Clock	115	(DD)
18				*	Receiver Debit Clock		
19	RTS (S)			*	Secondary RTS	120	(SCA)
20	DTR	*		*	Data Terminal Ready	108.2	(CD)
21	SQ		*		Signal Quality Detect	110	(CG)
22	RI		*		Ring Indicator	125	(CE)
23			*	*	Data Rate Select	111/112	(CH.CI)
24	(TC)			*	External Transmitter Clock	113	(DA)
25				*	Busy		

*Indicates signal direction.

NOTES: Positive voltage equals binary zero/space/on.
Negative voltage equals binary one/mark/off.

3.2.8.2 Modem to Phone Line Interface. The modem shall be directly connected to the dedicated leased data lines or microwave.

3.3 Physical Characteristics. The physical interface consists of a single connection using a modular jack to the data line.

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APPENDIX A

1.1 Logic Unit Assignment. This appendix contains the ATCBI-5 Logical Unit Assignments for an ARSR-4/ATCBI-5 Site Remote Monitoring Subsystem (RMS). Tables 1 through 11 are REFERENCE tables only. That is, these tables do not exist in the RMS source code. It is true that the RMS is a table driven program; however, when the RMS source code refers to "tables", it is really talking about an array of structures. LU and ID are in hexadecimal. The commands assigned to logical unit 2D (hex), not listed here, are for the LOCAL PC program only; they are not used by the MPS. At power-up or reset, the RMS initializes measurement data points to the unmonitored status of "B" (not listed here). As the values are established, the actual value and status of each data point is then updated. The highlighted entries are not used in this system, but may be used in other Beacon RMS systems. When the highlighted entries appear at the end of the table, the Site Data Report for the particular Logical Unit will end with the last data point used. If the highlighted entries are scattered throughout the table, the Site Data Report will have fillers for these data points.

TABLE A-1. ATCBI-5 REMOTE CONTROL COMMANDS (LU 20, 22, 24, and 25)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION
20	MPS		RMS MASTER	RMS Status		RMS Status Request
20	MPS	27	RMS MASTER	Database Download	YY/MM/DD/HH/MM/SS	MPS Date and Time to RMS
20	MPS	80	RMS MASTER	RMS Reset	1	Reset RMS
20	MPS	81	RMS MASTER	Set RMS Clock	Not Used	Database Download Req.
22	MPS		ENVIRO	Environmental Status		Environmental Status Req.
22	PIO	A0	ENVIRO	E/G #1 Start	1	Start on Equipment
					2	Start on Load Bank
22	PIO	A1	ENVIRO	E/G #1 Stop	0	Stop
22	PIO	A2	ENVIRO	E/G #1 Lockout Reset	0	Reset
22	PIO	A3	ENVIRO	Fuel Tank Value	11	Tank 1 Open
					12	Tank 1 Closed
					21	Tank 2 Open
					22	Tank 2 Closed
					31	Tank 3 Open
					32	Tank 3 Closed
					41	Tank 4 Open
					42	Tank 4 Closed
					91	Tank 5 Open
					52	Tank 5 Closed
22	PIO	A4	ENVIRO	Power Conditioner # 1 Reset	0	Reset
22	PIO	A5	ENVIRO	Intrusion System Control	1	Disable/Enable (toggle)
22	PIO	A6	ENVIRO	E/G #2 Start	1	Start on Equipment
					2	Start on Load Bank
22	PIO	A7	ENVIRO	E/G #2 Stop	0	Stop
22	PIO	A8	ENVIRO	E/G #2 Lockout Reset	0	Reset
22	PIO	A9	ENVIRO	Power Conditioner # 2 Reset	0	Reset
24	MPS		ATCBI_1	ATCBI Ch 1 Status		ATCBI Ch 1 Status Req.
24	MPS	80	ATCBI_1	ATCBI Ch 1 Power Adjust State	1	Auto
					2	Manual
24	MPS	81	ATCBI_1	ATCBI Channel Change State	1	Auto
					2	Manual
24	MPS	82	ATCBI_1	ATCBI Receiver Channel Change State	1	Auto
					2	Manual
24	GPIB	83	ATCBI_1	ATCBI Standby High Voltage	1	On
					2	Off
24	PIO	84	ATCBI_1	ISM Reset	1	ISM 1
					2	ISM 2
24	PIO	85	ATCBI_1	ATCBI Ch 1 Adjust Power Step	1	Up
					2	Down
24	PIO	86	ATCBI_1	ATCBI Channel Select	1	Channel 1
					2	Channel 2
25	MPS		ATCBI_2	ATCBI Ch 2 Status		ATCBI Ch 2 Status Req.
25	MPS	80	ATCBI_2	ATCBI Ch 2 Power Adjust State	1	Auto
					2	Manual
25	PIO	85	ATCBI_2	ATCBI Ch 2 Adjust Power Step	1	Up
					2	Down

TABLE A-1. REMOTE CONTROL COMMANDS (LU 26 and 2A) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION
26	CD2		CD-2 INTERIM	CD2 ChA Status		CD2 ChA Status Req.
26	CD2	80	CD-2 INTERIM	CD2 ChA/B Reset	1	Channel A
					2	Channel B
26	CD2	81	CD-2 INTERIM	MC Reset	1	Reset MC
26	CD2	82	CD-2 INTERIM	CD2 Channel Change State	1	Toggle AUTO/MANUAL
26	CD2	83	CD-2 INTERIM	CD2 Channel Select	1	Channel A
					2	Channel B
26	CD2	84	CD-2 INTERIM	MG Reset	1	Reset MG
26	CD2	85	CD-2 INTERIM	CD2 Total Reset	1	Reset ChA/ChB/MC/MG
27	CD2		CD-2 INTERIM	CD2 ChB Status		CD2 ChB Status Req.
28	CD1		CD-1	CD1 Status		CD1 Status Req.
28	MPS	80	CD-1	Clear-Reset Status	1	Auto
					2	Manual
28	MPS	81	CD-1	Reset Memory Clear Counter to Zero	0	Reset Memory Clear Counter
28	MPS	82	CD-1	Reset Alarm Reset Counter To Zero	0	Reset Alarm Reset Counter
28	PIO	83	CD-1	Memory Clear	0	Memory Clear
28	PIO	84	CD-1	Alarm Reset	0	Alarm Reset
28	PIO	85	CD-1	Power Reset	1	On
					2	Off
28	PIO	86	CD-1	Data Channel Select	11	Ch 1 On
					12	Ch 1 Off
					21	Ch 2 On
					22	Ch 2 Off
					31	Ch 3 On
					32	Ch 3 Off
28	PIO	87	CD-1	Data Channel Local/Remote	1	Local
					2	Remote
29	ADU		ADU	ADU Status		ADU Status Req.
2A	PIO	80	ASU	Trigger Generator Select	1	Select Trig Gen #1
					2	Select Trig Gen #2
FF	MPS		ALL	All Status		All Status Req.

TABLE A-2. RMS MASTER MEASUREMENT & DATA POINT CONFIGURATION (LU 20)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
20	MPS	20	RMS MASTER	Command Lines Enabled	0	Disabled	E	1.
					1	Enabled	A	1.
20	MPS	21	RMS MASTER	RMS Local Control	0	Remote	A	1.
					1	Local	A	1.
20	MPS	22	RMS MASTER	Schedule Poll Request	1	Schedule Poll	A	1.
20	MPS	23	RMS MASTER	Sign Out Status	0	Normal	A	1.
					1	Switch Alarm	E	1.
20	MPS	24	RMS MASTER	Technician Sign In/Out	0	No One Logged On	B	1.
					(A-Z)xx	String of 3 ASCII Char	A	1.
20	GPIB	25	RMS MASTER	GPIB ISM#1 Lost Communication	0	Offline	A	1.
					1	Online	A	1.
20	GPIB	26	RMS MASTER	GPIB ISM #1 Timeout Counter	xxxxx	0-37560	A	1.
20	GPIB	27	RMS MASTER	GPIB ISM #2 Lost Communication	0	Offline	A	1.
					1	Online	A	1.
20	GPIB	28	RMS MASTER	GPIB ISM#2 Timeout Counter	xxxxx	0-37560	A	1.
20	GPIB	29	RMS MASTER	GPIB WFA Lost Communication	0	Offline	C	1.
					1	Online	A	1.
20	GPIB	2A	RMS MASTER	GPIB WFA Timeout Counter	xxxxx	0-37560	A	1.
20	GPIB	2B	RMS MASTER	GPIB WFA RMX Error	0	Offline	A	1.
20	MPS	2C	RMS MASTER	Digital Status RMX Error	LLCC	Loc/Count	A/C	1.
20	MPS	2D	RMS MASTER	Digital Command RMX Error	LLCC	Loc/Count	A/C	1.
20	MPS	2E	RMS MASTER	Digital Command Error	EECC		A	1.
20	MPS	2F	RMS MASTER					
20	MPS	30	RMS MASTER					
20	MPS	31	RMS MASTER	Analog Status RMX Error	LLCC	Loc/Count	A/C	1.
20	MPS	32	RMS MASTER	Analog Hardware Error	0000	Normal	A	1.
					0100	Analog Card #1	C	1.
					0200	Analog Card #2	C	1.
					0400	Analog Card #3	C	1.
					0800	Temperature Card	C	1.
						Temp Sensors	C	1.
					1000	E/G Bldg Temp	C	1.
					1001	A/C #1 Inlet Temp	C	1.
					1002	A/C #1 Outlet Temp	C	1.
					1003	A/C #2 Inlet Temp	C	1.
					1004	A/C #2 Outlet Temp	C	1.
					1005	A/C #3 Inlet Temp	C	1.
					1006	A/C #3 Outlet Temp	C	1.
					1007	A/C #4 Inlet Temp	C	1.
					1008	A/C #4 Outlet Temp	C	1.
					1009	Tx Room Temp	C	1.
					100A	Radar Room Temp	C	1.
					100B	Pwr Cond Bldg Temp	C	1.
					100C	Outside Temp	C	1.
20	MPS	33	RMS MASTER	Analog Function Error	xxxx		A	1.
20	MPS	34	RMS MASTER	History RMX Error	xxxx		A	1.
20	MPS	35	RMS MASTER					
20	MPS	36	RMS MASTER					
20	MPS	37	RMS MASTER					
20	MPS	38	RMS MASTER					
20	MPS	39	RMS MASTER					
20	MPS	3A	RMS MASTER					
20	MPS	3B	RMS MASTER					
20	MPS	3C	RMS MASTER					
20	MPS	3D	RMS MASTER					
20	MPS	3E	RMS MASTER					
20	MPS	3F	RMS MASTER					

TABLE A-2. RMS MASTER MEASUREMENT & DATA POINT CONFIGURATION (LU 20) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
20	MPS	40	RMS MASTER	RMS Auxiliary Power Supply +5 Volts	x.x	5.0 Volts	A/C/D/E/F	.1
20	MPS	41	RMS MASTER	RMS Auxiliary Power Supply +12 Volts	xx.x	12.0 Volts	A/C/D/E/F	.1
20	MPS	42	RMS MASTER	RMS Auxiliary Power Supply -12 Volts	xx.x	12.0 Volts	A/C/D/E/F	.1
20	MPS	43	RMS MASTER	RMS Auxiliary Power Supply +24 Volts	xx.x	24.0 Volts	A/C/D/E/F	.1
20	MPS	44	RMS MASTER	Temperature Power Supply +15 Volts	xx.x	15.0 Volts	A/C/D/E/F	.1
20	MPS	45	RMS MASTER	RMS UPS Status	0	Normal	A	1.
					1	Alarm	C	1.
20	MPS	FD	RMS MASTER	Last Command Received		Last Cmd to MPS		
20	MPS	FE	RMS MASTER	Last Command Result		Last Cmd Result		

TABLE A-3. ENVIRONMENTAL MEASUREMENT & DATA POINT CONFIGURATION (LU 22)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
22	PIO	20	ENVIRO	E/G #1 Over Speed Lockout Alarm	0	Normal	A	1.
					1	Alarm	C	1.
22	PIO	21	ENVIRO	E/G #1 Over Temp Lockout Alarm	0	Normal	A	1.
					1	Alarm	C	1.
22	PIO	22	ENVIRO	E/G #1 Oil Pressure Lockout Alarm	0	Normal	A	1.
					1	Alarm	C	1.
22	PIO	23	ENVIRO	E/G #1 Over Crank Lockout Alarm	0	Normal	A	1.
					1	Alarm	C	1.
22	PIO	24	ENVIRO	E/G #1 Status	0	Not Running	A	1.
					1	Running	E	1.
					2	Cranking	A	1.
22	PIO	25	ENVIRO	E/G #1 Load Status	0	Off	A	1.
					1	Facility	A	1.
					2	Load Bank	A	1.
					3	No Load	A	1.
22	PIO	26	ENVIRO	Facility Load Supply	0	Commercial	A	1.
					1	E/G #1	A	1.
					2	E/G #2	A	1.
					3	Pwr Cond #1	C	1.
					4	Pwr Cond #2	C	1.
22	PIO	27	ENVIRO	E/G #1 Remote Control By-Pass	0	Normal	A	1.
					1	Bypass	A	1.
22	PIO	28	ENVIRO	Pwr Cond #1 Input Circuit Breaker	0	Open	A	1.
					1	Closed	A	1.
22	PIO	29	ENVIRO	Pwr Cond #1 Battery Circuit Breaker	0	Open	A	1.
					1	Closed	A	1.
22	PIO	2A	ENVIRO	Pwr Cond #1 Output Circuit Breaker	0	Open	A	1.
					1	Closed	A	1.
22	PIO	2B	ENVIRO	Pwr Cond #1 Bypass Circuit Breaker	0	Open	A	1.
					1	Closed	A	1.
22	PIO	2C	ENVIRO	A/C #1 Status	0	Normal (Air/Pres)	A	1.
					1	Air Flow	C	1.
					2	High Pressure	C	1.
					3	Low Pressure	C	1.
22	PIO	2D	ENVIRO	A/C #2 Status	0	Normal (Air/Pres)	A	1.
					1	Air Flow	C	1.
					2	High Pressure	C	1.
					3	Low Pressure	C	1.
22	PIO	2E	ENVIRO	A/C #3 Status	0	Normal (Air/Pres)	A	1.
					1	Air Flow	C	1.
					2	High Pressure	C	1.
					3	Low Pressure	C	1.
22	PIO	2F	ENVIRO	A/C #4 Status	0	Normal (Air/Pres)	A	1.
					1	Air Flow	C	1.
					2	High Pressure	C	1.
					3	Low Pressure	C	1.
22	PIO	30	ENVIRO	A/C #1 Compressor Status	0	Running	A	1.
					1	Not Running	A	1.
22	PIO	31	ENVIRO	A/C #2 Compressor Status	0	Running	A	1.
					1	Not Running	A	1.
22	PIO	32	ENVIRO	A/C #3 Compressor Status	0	Running	A	1.
					1	Not Running	A	1.
22	PIO	33	ENVIRO	A/C #4 Compressor Status	0	Running	A	1.
					1	Not Running	A	1.
22	PIO	34	ENVIRO	Building Intrusion Alarm RB	0	Armed	A	1.
					1	Alarm	C	1.
					2	Disarmed	A	1.
22	PIO	35	ENVIRO	Fire Alarm RB	0	Normal	A	1.
					1	Alarm	C	1.
22	PIO	36	ENVIRO	Not Used				

TABLE A-3. ENVIRONMENTAL MEASUREMENT & DATA POINT CONFIGURATION (LU 22) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
22	AD	37	ENVIRO	Fuel Tank #1 Level	xxx.x	0 inch, 999.9 inches	A/C/D/E/F	.1
22	AD	38	ENVIRO	Fuel Tank #2 Level	xxx.x	0 inch, 999.9 inches	A/C/D/E/F	.1
22	AD	39	ENVIRO	Fuel Tank #3 Level	xxx.x	0 inch, 999.9 inches	A/C/D/E/F	.1
22	AD	3A	ENVIRO	Fuel Tank #4 Level	xxx.x	0 inch, 999.9 inches	A/C/D/E/F	.1
22	AD	3B	ENVIRO	Fuel Tank #5 Level	xxx.x	0 inch, 999.9 inches	A/C/D/E/F	.1
22	AD	3C	ENVIRO	Pwr Cond #1 Input Voltage Phase A	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	3D	ENVIRO	Pwr Cond #1 Input Voltage Phase B	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	3E	ENVIRO	Pwr Cond #1 Input Voltage Phase C	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	3F	ENVIRO	Not Used				
22	AD	40	ENVIRO	E/G #1 Load Bank Current	xxx.x	0 Amps, 300 Amps	A	.1
22	AD	41	ENVIRO	E/G #1 Battery Voltage	xx.x	0 Vdc, 30 Vdc	A/C/D/E/F	.1
22	AD	42	ENVIRO	E/G #1 Coolant Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	43	ENVIRO	E/G #1 Oil Pressure	xxx	0 Lbs, 100Lbs	A/C/D/E/F	1.
22	AD	44	ENVIRO	E/G #1 AC Voltage Phase A	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	45	ENVIRO	E/G #1 AC Voltage Phase B	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	46	ENVIRO	E/G #1 AC Voltage Phase C	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	47	ENVIRO	E/G #1 AC Current Phase A	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	48	ENVIRO	E/G #1 AC Current Phase B	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	49	ENVIRO	E/G #1 AC Current Phase C	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	4A	ENVIRO	E/G Building Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	4B	ENVIRO	Commercial AC Voltage Phase A	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	4C	ENVIRO	Commercial AC Voltage Phase B	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	4D	ENVIRO	Commercial AC Voltage Phase C	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	4E	ENVIRO	Facility Load Current Phase A	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	4F	ENVIRO	Facility Load Current Phase B	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	50	ENVIRO	Facility Load Current Phase C	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	51	ENVIRO	Not Used				
22	AD	52	ENVIRO	Pwr Cond #1 Output Voltage Phase A	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	53	ENVIRO	Pwr Cond #1 Output Voltage Phase B	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	54	ENVIRO	Pwr Cond #1 Output Voltage Phase C	xxx.x	0 Vac, 120 Vac	A/C/D/E/F	.1
22	AD	55	ENVIRO	Pwr Cond #1 AC Current Phase A	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1

TABLE A-3. ENVIRONMENTAL MEASUREMENT & DATA POINT CONFIGURATION (LU 22) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
22	AD	56	ENVIRO	Pwr Cond #1 AC Current Phase B	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	57	ENVIRO	Pwr Cond #1 AC Current Phase C	xxx.x	0 Amps, 300 Amps	A/C/D/E/F	.1
22	AD	58	ENVIRO	A/C #1 Inlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	59	ENVIRO	A/C #1 Outlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5A	ENVIRO	A/C #2 Inlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5B	ENVIRO	A/C #2 Outlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5C	ENVIRO	A/C #3 Inlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5D	ENVIRO	A/C #3 Outlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5E	ENVIRO	A/C #4 Inlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	5F	ENVIRO	A/C #4 Outlet Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	60	ENVIRO	Transmitter Room Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	61	ENVIRO	Radar Building Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	62	ENVIRO	Pwr Cond Building Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	63	ENVIRO	Outside Temperature	xxx	-70 °F, +212 °F	A/C/D/E/F	1.
22	AD	64	ENVIRO	E/G #1 Frequency	xx.x	55.0 Hz to 65.0 Hz	A/C/D/E/F	.1
22	AD	65	ENVIRO	Commercial Frequency	xx.x	55.0 Hz to 65.0 Hz	A/C/D/E/F	.1
22	AD	66	ENVIRO	E/G #2 Frequency	xx.x	55.0 Hz to 65.0 Hz	A/C/D/E/F	.1
22	AD	67	ENVIRO	Pwr Cond #1 Frequency	xx.x	55.0 Hz to 65.0 Hz	A/C/D/E/F	.1

22	AD	68	ENVIRO	Pwr Cond #2 Frequency	xx.x	55.0 Hz to 65.0 Hz	A/C/D/E/F	1
22		69	ENVIRO	"				
22		6A	ENVIRO	"				
22		6B	ENVIRO	"				
22		6C	ENVIRO	"				
22		6D	ENVIRO	"				
22		6E	ENVIRO	"				
22		6F	ENVIRO	"				

TABLE A-3. ENVIRONMENTAL MEASUREMENT & DATA POINT CONFIGURATION (LU 22) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
22	PIO	70	ENVIRO	E/G #2 Over Speed Lockout Alarm	0	Normal	A	1
					1	Alarm	C	1
22	PIO	71	ENVIRO	E/G #2 Over Temp Lockout Alarm	0	Normal	A	1
					1	Alarm	C	1
22	PIO	72	ENVIRO	E/G #2 Oil Pressure Lockout Alarm	0	Normal	A	1
					1	Alarm	C	1
22	PIO	73	ENVIRO	E/G #2 Over Crank Lockout Alarm	0	Normal	A	1
					1	Alarm	C	1
22	PIO	74	ENVIRO	E/G #2 Status	0	Not Running	A	1
					1	Running	E	1
					2	Cranking	A	1
22	PIO	75	ENVIRO	E/G #2 Load Status	0	Off	A	1
					1	Facility	A	1
					2	Load Bank	A	1
					3	No Load	A	1
22	PIO	76	ENVIRO	Not Used				
22	PIO	77	ENVIRO	E/G #2 Remote Control By-Pass	0	Normal	A	1
					1	Bypass	A	1
22	PIO	78	ENVIRO	Pwr Cond #2 Input Circuit Breaker	0	Open	A	1
					1	Closed	A	1
22	PIO	79	ENVIRO	Pwr Cond #2 Battery Circuit Breaker	0	Open	A	1
					1	Closed	A	1
22	PIO	7A	ENVIRO	Pwr Cond #2 Output Circuit Breaker	0	Open	A	1
					1	Closed	A	1
22	PIO	7B	ENVIRO	Pwr Cond #2 Bypass Circuit Breaker	0	Open	A	1
					1	Closed	A	1
22	AD	7C	ENVIRO	Pwr Cond #2 Input Voltage Phase A	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	7D	ENVIRO	Pwr Cond #2 Input Voltage Phase B	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	7E	ENVIRO	Pwr Cond #2 Input Voltage Phase C	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	7F	ENVIRO	Not Used				
22	AD	80	ENVIRO	E/G #2 Load Bank Current	xxx	0 Amps, 300 Amps	A	1
22	AD	81	ENVIRO	E/G #2 Battery Voltage	xx	0 Vdc, 30 Vdc	A/C/D/E/F	1
22	AD	82	ENVIRO	E/G #2 Coolant Temperature	xx	-70 °F, +212 °F	A/C/D/E/F	1
22	AD	83	ENVIRO	E/G #2 Oil Pressure	xxx	0 Lbs, 100Lbs	A/C/D/E/F	1
22	AD	84	ENVIRO	E/G #2 AC Voltage Phase A	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	85	ENVIRO	E/G #2 AC Voltage Phase B	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	86	ENVIRO	E/G #2 AC Voltage Phase C	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	87	ENVIRO	E/G #2 AC Current Phase A	xxx	0 Amps, 300 Amps	A/C/D/E/F	1
22	AD	88	ENVIRO	E/G #2 AC Current Phase B	xxx	0 Amps, 300 Amps	A/C/D/E/F	1
22	AD	89	ENVIRO	E/G #2 AC Current Phase C	xxx	0 Amps, 300 Amps	A/C/D/E/F	1
22	AD	8A	ENVIRO	Pwr Cond #2 Output Voltage Phase A	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	8B	ENVIRO	Pwr Cond #2 Output Voltage Phase B	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	8C	ENVIRO	Pwr Cond #2 Output Voltage Phase C	xxx	0 Vac, 120 Vac	A/C/D/E/F	1
22	AD	8D	ENVIRO	Pwr Cond #2 AC Current Phase A	xxx	0 Amps, 300 Amps	A/C/D/E/F	1
22	AD	8E	ENVIRO	Pwr Cond #2 AC Current Phase B	xxx	0 Amps, 300 Amps	A/C/D/E/F	1
22	AD	8F	ENVIRO	Pwr Cond #2 AC Current Phase C	xxx	0 Amps, 300 Amps	A/C/D/E/F	1

TABLE A-4. RMS COMMUNICATION (LU 23)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
23	MPS	01	MPS	MPS/RMS Communication Test		Normal	A	1
						Fault	C	1
23	MPS	20	RMS	MPS Communications	0	Alarm	C	1
					1	Normal	A	1

TABLE A-5. ATCBI-5 BEACON CHANNEL 1 MEASUREMENT & DATA POINT CONFIGURATION (LU 24)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
24	MPS	20	ATCBI_1					
24	MPS	21	ATCBI_1	ATCBI Channel Change	1	Auto	A	1.
					2	Manual	A	1.
24	MPS	22	ATCBI_1	ATCBI Ch 1 Power Adjust	1	Auto	A	1.
					2	Manual	A	1.
24	PIO	23	ATCBI_1	ATCBI Ch 1 Power Adjust Step	0	Step 0	A	1.
					1	Step 1	A	1.
					2	Step 2	A	1.
					3	Step 3	A	1.
					4	Step 4	A	1.
					5	Step 5	A	1.
					6	Step 6	A	1.
					7	Step 7	A	1.
24	MPS	24	ATCBI_1	ATCBI Receiver Channel Change	1	Auto	A	1.
					2	Manual	A	1.
24		25						
24	AD	26	ATCBI_1	ATCBI-5 Ch 1 +6 Volt P.S.	x.x	6.0 Vdc	A/C/D/E/F	.1
24	AD	27	ATCBI_1	ATCBI-5 Ch 1 +12 Volt P.S.	xx.x	12.0 Vdc	A/C/D/E/F	.1
24	AD	28	ATCBI_1	ATCBI-5 Ch 1 +48 Volt P.S.	xx.x	48.0 Vdc	A/C/D/E/F	.1
24	AD	29	ATCBI_1	ATCBI-5 Ch 1 +24 Volt P.S.	xx.x	24.0 Vdc	A/C/D/E/F	.1
24	AD	2A	ATCBI_1	ATCBI-5 Ch 1 -6 Volt P.S.	x.x	6.0 Vdc	A/C/D/E/F	.1
24	AD	2B	ATCBI_1	ATCBI-5 Ch 1 -75 Volt P.S.	xx.x	75.0 Vdc	A/C/D/E/F	.1
24	AD	2C	ATCBI_1	Ch 1 Finals Hi Volt. P.S.	x.x	K Volts dc	A/C/D/E/F	.1
24	AD	2D	ATCBI_1	Ch 1 Finals Bias Volt	xx.x	Volts dc	A/C/D/E/F	.1
24	GPIB	2E	ATCBI_1	Ch 1 P1 Directional Power	xx.x	dBm	A/C/D/E/F	.1
24	GPIB	2F	ATCBI_1	Ch 1 P3 Directional Power	xx.x	dBm	A/C/D/E/F	.1
24	GPIB	30	ATCBI_1	Ch 1 Quantizer Threshold	xx.x	dBm	A/C/D/E/F	.1
24	GPIB	31	ATCBI_1	Ch 1 P1 Omni Power	xx.x	dBm	A/C/D/E/F	.1
24	GPIB	32	ATCBI_1	Ch 1 P2 Omni Power	xx.x	dBm	A/C/D/E/F	.1
24	GPIB	33	ATCBI_1	Ch 1 P1 Pulse Width Directional	x.xx	0.80 sec	A/C/D/E/F	.01
24	GPIB	34	ATCBI_1	Ch 1 P2 Pulse Width Omni	x.xx	0.80 sec	A/C/D/E/F	.01
24	GPIB	35	ATCBI_1	Ch 1 P3 Pulse Width Directional	x.xx	0.80 sec	A/C/D/E/F	.01
24	GPIB	36	ATCBI_1	Ch 1 P1 Pulse Width Omni	x.xx	0.80 sec	A/C/D/E/F	.01
24	GPIB	37	ATCBI_1	Ch 1 STC 1	xx.x	sec	A/C/D/E/F	.1
24	GPIB	38	ATCBI_1	Ch 1 STC 2	xx.x	sec	A/C/D/E/F	.1
24	GPIB	39	ATCBI_1	Ch 1 STC 3	xx.x	sec	A/C/D/E/F	.1

TABLE A-5. ATCBI-5 BEACON CHANNEL 1 MEASUREMENT & DATA POINT CONFIGURATION (LU 24) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
24	GPIB	3A	ATCBI_1	Ch 1 Quantized Video	x.x	Volts	A/C/D/E/F	.1
24	GPIB	3B	ATCBI_1	Ch 1 VSWR Directional	x.xx		A/C/D/E/F	.01
24	GPIB	3C	ATCBI_1	Ch 1 VSWR Omni	x.xx		A/C/D/E/F	.01
24	GPIB	3D	ATCBI_1	Ch 1 RSM Azimuth	xxxx	ACPs	A/C/D/E/F	1.
24	GPIB	3E	ATCBI_1	Ch 1 RSM Range	xxx.x	nmi	A/C/D/E/F	.1
24	GPIB	3F	ATCBI_1	Ch 1 RSM Replies	xx		A/C/D/E/F	1.
24	GPIB	40	ATCBI_1	Ch 1 Azimuth Pulse Gen. ACP's	xxxx	4096 ACPs	A/C/D/E/F	1.

TABLE A-5. ATCBI-5 BEACON CHANNEL 1 MEASUREMENT & DATA POINT CONFIGURATION (LU 24) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
24	GPIB	41	ATCBI_1	Ch 1 ISM1-TTG-ON-LINE-PWR	0	Off	A	1.
					1	On	A	1.
24	GPIB	42	ATCBI_1	Ch 1 ISM1-TTG-ON-LINE-RG-AZ	0	Off	A	1.
					1	On	A	1.
24	GPIB	43	ATCBI_1	Ch 1 ISM1-TTG-ON-LINE-INT-REF	0	Off	A	1.
					1	On	E	1.
24	GPIB	44	ATCBI_1	Ch 1 ISM1-TTG-ON-LINE-TIMING	0	Off	A	1.
					1	On	A	1.
24	GPIB	45	ATCBI_1	Ch 1 ISM1-TTG-ON-LINE-RCVR	0	Off	A	1.
					1	On	A	1.
24	GPIB	46	ATCBI_1	Ch 1 ISM1-TTG-STBY-INT-REF	0	Off	A	1.
					1	On	E	1.
24	GPIB	47	ATCBI_1	Ch 1 ISM1-TTG-STBY-TIMNG	0	Off	A	1.
					1	On	A	1.
24	GPIB	48	ATCBI_1	Ch 1 ISM1-TTG-STBY-RCVR	0	Off	A	1.
					1	On	A	1.
24	GPIB	49	ATCBI_1	Ch 1 ISM1-TTG-STBY-PWR	0	Off	A	1.
					1	On	A	1.
24	GPIB	4A	ATCBI_1	Ch 1 ISM1-STAT-ISM-MAINT	0	Operate	A	1.
					1	Maint	A	1.
24	GPIB	4B	ATCBI_1	Ch 1 ISM1-STAT-STBY-HV	0	Off	A	1.
					1	On	A	1.
24	GPIB	4C	ATCBI_1	Ch 1 ISM1-STAT-RUN	0	Calibrate	A	1.
					1	Run	A	1.
24	GPIB	4D	ATCBI_1	Ch 1 ISM1-REF-TBD	0	Off	A	1.
					1	On	A	1.
24	GPIB	4E	ATCBI_1	Ch 1 ISM1-REF-TRIG	0	Off	A	1.
					1	On	A	1.
24	GPIB	4F	ATCBI_1	Ch 1 ISM1-REF-NO	0	Off	A	1.
					1	On	A	1.
24	GPIB	50	ATCBI_1	Ch 1 ISM1-REF-NOF	0	Off	A	1.
					1	On	A	1.
24	GPIB	51	ATCBI_1	Ch 1 ISM1-REF-CMPST	0	Off	A	1.
					1	On	A	1.
24	GPIB	52	ATCBI_1	Ch 1 ISM1-REF-RAM5V	0	Off	A	1.
					1	On	A	1.
24	GPIB	53	ATCBI_1	Ch 1 ISM1-REF-+15-VR	0	Off	A	1.
					1	On	A	1.
24	GPIB	54	ATCBI_1	Ch 1 ISM1-REF-PS	0	Off	A	1.
					1	On	A	1.
24	GPIB	55	ATCBI_1	Ch 1 Mode 3/A Pulse Spacing	xx.x	8.0 sec	A/C/D/E/F	.1
24	GPIB	56	ATCBI_1	Ch 1 Mode C Pulse Spacing	xx.x	21.0 sec	A/C/D/E/F	.1
24	GPIB	57	ATCBI_1	Ch 1 ISLS Pulse Spacing	xx.x	2.0 sec	A/C/D/E/F	.1
24	GPIB	58	ATCBI_1	Not Used				
24	GPIB	59	ATCBI_1	Ch 1 Defruiter Video	x.x	Volts	A/C/D/E/F	.1
24	PIO	5A	ATCBI_1	ATCBI Ch 1 Trigger Timing Alarm	0	Normal	A	1.
					1	Alarm	C	1.
24	PIO	5B	ATCBI_1	ATCBI Ch 1 High Voltage Alarm	0	Normal	A	1.
					1	Alarm	C	1.
24	PIO	5C	ATCBI_1	ATCBI Ch 1 Maint Switch On	0	Operate	A	1.
					1	Maint	A	1.
24	PIO	5D	ATCBI_1	ATCBI Ch 1 Channel Selected	0	Not Selected	A	1.
					1	Selected	A	1.
24	PIO	5E		ATCBI Control Transfer Unit	0	Remote	A	1.
					1	Local	A	1.
24	PIO	5F						

TABLE A-6. ATCBI-5 BEACON CHANNEL 2 MEASUREMENT & DATA POINT CONFIGURATION (LU 25)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
25		20						
25	MPS	21	ATCBI_2	Not Used				
25	MPS	22	ATCBI_2	ATCBI Ch 2 Power Adjust	1	Auto	A	1.
					2	Manual	A	1.
25	PIO	23	ATCBI_2	ATCBI Ch 2 Power Adjust Step	0	Step 0	A	1.
					1	Step 1	A	1.
					2	Step 2	A	1.
					3	Step 3	A	1.
					4	Step 4	A	1.
					5	Step 5	A	1.
					6	Step 6	A	1.
					7	Step 7	A	1.
25	MPS	24	ATCBI_2	Not Used				
25		25						
25	AD	26	ATCBI_2	ATCBI-5 Ch 2 +6 Volt P.S.	x.x	6.0 Vdc	A/C/D/E/F	.1
25	AD	27	ATCBI_2	ATCBI-5 Ch 2 +12 Volt P.S.	xx.x	12.0 Vdc	A/C/D/E/F	.1
25	AD	28	ATCBI_2	ATCBI-5 Ch 2 +48 Volt P.S.	xx.x	48.0 Vdc	A/C/D/E/F	.1
25	AD	29	ATCBI_2	ATCBI-5 Ch 2 +24 Volt P.S.	xx.x	24.0 Vdc	A/C/D/E/F	.1
25	AD	2A	ATCBI_2	ATCBI-5 Ch 2 -6 Volt P.S.	x.x	6.0 Vdc	A/C/D/E/F	.1
25	AD	2B	ATCBI_2	ATCBI-5 Ch 2 -75 Volt P.S.	xx.x	75.0 Vdc	A/C/D/E/F	.1
25	AD	2C	ATCBI_2	Ch 2 Finals Hi Volt. P.S.	x.x	K Volts dc	A/C/D/E/F	.1
25	AD	2D	ATCBI_2	Ch 2 Finals Bias Volt	xx.x	Volts dc	A/C/D/E/F	.1
25	GPIB	2E	ATCBI_2	Ch 2 P1 Directional Power	xx.x	dBm	A/C/D/E/F	.1
25	GPIB	2F	ATCBI_2	Ch 2 P3 Directional Power	xx.x	dBm	A/C/D/E/F	.1
25	GPIB	30	ATCBI_2	Ch 2 Quantizer Threshold	xx.x	dBm	A/C/D/E/F	.1
25	GPIB	31	ATCBI_2	Ch 2 P1 Omni Power	xx.x	dBm	A/C/D/E/F	.1
25	GPIB	32	ATCBI_2	Ch 2 P2 Omni Power	xx.x	dBm	A/C/D/E/F	.1
25	GPIB	33	ATCBI_2	Ch 2 P1 Pulse Width Directional	x.xx	0.80 sec	A/C/D/E/F	.01
25	GPIB	34	ATCBI_2	Ch 2 P2 Pulse Width Omni	x.xx	0.80 sec	A/C/D/E/F	.01
25	GPIB	35	ATCBI_2	Ch 2 P3 Pulse Width Directional	x.xx	0.80 sec	A/C/D/E/F	.01
25	GPIB	36	ATCBI_2	Ch 2 P1 Pulse Width Omni	x.xx	0.80 sec	A/C/D/E/F	.01
25	GPIB	37	ATCBI_2	Ch 2 STC 1	xx.x	sec	A/C/D/E/F	.1
25	GPIB	38	ATCBI_2	Ch 2 STC 2	xx.x	sec	A/C/D/E/F	.1
25	GPIB	39	ATCBI_2	Ch 2 STC 3	xx.x	sec	A/C/D/E/F	.1
25	GPIB	3A	ATCBI_2	Ch 2 Quantized Video	x.x	Volts	A/C/D/E/F	.1
25	GPIB	3B	ATCBI_2	Ch 2 VSWR Directional	x.xx		A/C/D/E/F	.01
25	GPIB	3C	ATCBI_2	Ch 2 VSWR Omni	x.xx		A/C/D/E/F	.01
25	GPIB	3D	ATCBI_2	Ch 2 RSM Azimuth	xxx	ACPs	A/C/D/E/F	1.
25	GPIB	3E	ATCBI_2	Ch 2 RSM Range	xxx.x	nmi	A/C/D/E/F	.1

TABLE A-6. ATCBI-5 BEACON CHANNEL 2 MEASUREMENT & DATA POINT CONFIGURATION (LU 25) (CONTINUED)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
25	GPIB	3F	ATCBI_2	Ch 2 RSM Replies	xx		A/C/D/E/F	1.
25	GPIB	40	ATCBI_2	Ch 2 Azimuth Pulse Gen. ACP's	xxxx	4096 ACPs	A/C/D/E/F	1.
25	GPIB	41	ATCBI_2	Ch 2 ISM2-TTG-ON-LINE-PWR	0	Off	A	1.
					1	On	A	1.
25	GPIB	42	ATCBI_2	Ch 2 ISM2-TTG-ON-LINE-RG-AZ	0	Off	A	1.
					1	On	A	1.
25	GPIB	43	ATCBI_2	Ch 2 ISM2-TTG-ON-LINE-INT-REF	0	Off	A	1.
					1	On	E	1.
25	GPIB	44	ATCBI_2	Ch 2 ISM2-TTG-ON-LINE-TIMING	0	Off	A	1.
					1	On	A	1.
25	GPIB	45	ATCBI_2	Ch 2 ISM2-TTG-ON-LINE-RCVR	0	Off	A	1.
					1	On	A	1.
25	GPIB	46	ATCBI_2	Ch 2 ISM2-TTG-STBY-INT-REF	0	Off	A	1.
					1	On	E	1.
25	GPIB	47	ATCBI_2	Ch 2 ISM2-TTG-STBY-TIMNG	0	Off	A	1.
					1	On	A	1.
25	GPIB	48	ATCBI_2	Ch 2 ISM2-TTG-STBY-RCVR	0	Off	A	1.
					1	On	A	1.
25	GPIB	49	ATCBI_2	Ch 2 ISM2-TTG-STBY-PWR	0	Off	A	1.
					1	On	A	1.
25	GPIB	4A	ATCBI_2	Ch 2 ISM2-STAT-ISM-MAINT	0	Operate	A	1.
					1	Maint	A	1.
25	GPIB	4B	ATCBI_2	Ch 2 ISM2-STAT-STBY-HV	0	Off	A	1.
					1	On	A	1.
25	GPIB	4C	ATCBI_2	Ch 2 ISM2-STAT-RUN	0	Calibrate	A	1.
					1	Run	A	1.
25	GPIB	4D	ATCBI_2	Ch 2 ISM2-REF-TBD	0	Off	A	1.
					1	On	A	1.
25	GPIB	4E	ATCBI_2	Ch 2 ISM2-REF-TRIG	0	Off	A	1.
					1	On	A	1.
25	GPIB	4F	ATCBI_2	Ch 2 ISM2-REF-NO	0	Off	A	1.
					1	On	A	1.
25	GPIB	50	ATCBI_2	Ch 2 ISM2-REF-NOF	0	Off	A	1.
					1	On	A	1.
25	GPIB	51	ATCBI_2	Ch 2 ISM2-REF-CMPST	0	Off	A	1.
					1	On	A	1.
25	GPIB	52	ATCBI_2	Ch 2 ISM2-REF-RAM5V	0	Off	A	1.
					1	On	A	1.
25	GPIB	53	ATCBI_2	Ch 2 ISM2-REF-+15-VR	0	Off	A	1.
					1	On	A	1.
25	GPIB	54	ATCBI_2	Ch 2 ISM2-REF-PS	0	Off	A	1.
					1	On	A	1.
25	GPIB	55	ATCBI_2	Ch 2 Mode 3/A Pulse Spacing	xx.x	8.0 sec	A/C/D/E/F	.1
25	GPIB	56	ATCBI_2	Ch 2 Mode C Pulse Spacing	xx.x	21.0 sec	A/C/D/E/F	.1
25	GPIB	57	ATCBI_2	Ch 2 ISLS Pulse Spacing	xx.x	2.0 sec	A/C/D/E/F	.1
25	GPIB	58	ATCBI_2	Not Assigned				
25	GPIB	59	ATCBI_2	Ch 2 Defruiter Video	x.x	Volts	A/C/D/E/F	.1
25	PIO	5A	ATCBI_2	ATCBI Ch 2 Trigger Timing Alarm	0	Normal	A	1.
					1	Alarm	C	1.
25	PIO	5B	ATCBI_2	ATCBI Ch 2 High Voltage Alarm	0	Normal	A	1.
					1	Alarm	C	1.
25	PIO	5C	ATCBI_2	ATCBI Ch 2 Maint Switch On	0	Operate	A	1.
					1	Maint	A	1.
25	PIO	5D	ATCBI_2	ATCBI Ch 2 Channel Selected	0	Not Selected	A	1.
					1	Selected	A	1.
25	PIO	5E		Not Used				
25	PIO	5F						

TABLE A-7. INTERIM COMMON DIGITIZER-2 CHANNEL A MEASUREMENT & DATA POINT CONFIGURATION (LU 26)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
26	MPS	20	CD-2 Ch A	CD2 Channel A	0	Not Selected	A	1
					1	Selected	A	1
26	CD-2	21	CD-2 Ch A	CD2 Auto Select	0	Manual	A	1
					1	Auto	A	1
26	CD-2	22	CD-2 Ch A	CD2 Maintenance Console	0	Normal	A	1
					1	Alarm	C	1
26	CD-2	23	CD-2 Ch A	CD2 Temperature	0	Normal	A	1
					1	Alarm	C	1
26	CD-2	24	CD-2 Ch A	CD2 MIG Status	0	Off-line	A	1
					1	On-line	A	1
26	CD-2	25	CD-2 Ch A	CD2 MIG Alarm Status	0	Normal	A	1
					1	Alarm	C	1
26	CD-2	26	CD-2 Ch A	IRMM Communication Status	0	Normal	A	1
					1	Alarm	C	1
26	CD-2	27	CD-2 Ch A	IRMM Local/Remote Status	0	Local	A	1
					1	Remote	A	1
26	CD-2	28	CD-2 Ch A	CD2 Channel A Health Count	xx	0 <= xx <= 15	A	1

TABLE A-8. INTERIM COMMON DIGITIZER-2 CHANNEL B MEASUREMENT & DATA POINT CONFIGURATION (LU 27)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
27	MPS	20	CD-2 Ch B	CD2 Channel B	0	Not Selected	A	1.
					1	Selected	A	1.
27	CD-2	21	CD-2 Ch B					
27	CD-2	22	CD-2 Ch B					
27	CD-2	23	CD-2 Ch B					
27	CD-2	24	CD-2 Ch B					
27	CD-2	25	CD-2 Ch B					
27	CD-2	26	CD-2 Ch B					
27	CD-2	27	CD-2 Ch B					
27	CD-2	28	CD-2 Ch B	CD2 Channel B Health Count	xx	0 <= xx <= 15	A	1.

TABLE A-9. COMMON DIGITIZER-1 MEASUREMENT & DATA POINT CONFIGURATION (LU 28)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
28	MPS	20	CD1					
28	MPS	21	CD1	CD1 Alarm Reset & Memory Clear Stat	1	Auto	A	1
					2	Manual	A	1
28	MPS	22	CD1	CD1 Alarm Reset Counter		0-4294967296	A	1
28	AD	23	CD1	CD1 Memory Clear Counter		0-4294967296	A	1
28	AD	24	CD1	+30 Volt P.S.	xx.x	30.0 Vdc	A/C/D/E/F	.1
28	AD	25	CD1	+20 Volt P.S.	xx.x	20.0 Vdc	A/C/D/E/F	.1
28	AD	26	CD1	+12 Volt P.S.	xx.x	12.0 Vdc	A/C/D/E/F	.1
28	AD	27	CD1	-20 Volt P.S.	xx.x	20.0 Vdc	A/C/D/E/F	.1
28	AD	28	CD1	-12 Volt P.S.	xx.x	12.0 Vdc	A/C/D/E/F	.1
28	AD	29	CD1	+5 Volt P.S.	xx.x	5.0 Vdc	A/C/D/E/F	.1
28	AD	2A	CD1	11/16 Volt P.S.	xx.x	13.4 Vdc	A/C/D/E/F	.1
28	AD	2B	CD1	CD1 Quantizer Clip Level	x.xx	78	A/C/D/E/F	.01
28	PIO	2C	CD1	CD1 Maintenance Switch	0	Operate	A	1
					1	Maint	A	1
28	PIO	2D	CD1	CD1 Output Service Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	2E	CD1	CD1 Range Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	2F	CD1	CD1 Beacon Message Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	30	CD1	CD1 Radar Beam Split Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	31	CD1	CD1 Beacon Beam Split Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	32	CD1	CD1 Sensitivity Detector Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	33	CD1	CD1 Beacon Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	34	CD1	CD1 Beacon Service Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	35	CD1	CD1 Buffer 3/4 Full Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	36	CD1	CD1 Buffer Overload Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	37	CD1	CD1 Buffer Overflow Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	38	CD1	CD1 System Overheat Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	39	CD1	CD1 Half Scan Inhibit Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3A	CD1	CD1 Input Processor Full Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3B	CD1	CD1 High Speed Timing Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3C	CD1	CD1 Internal Timing Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3D	CD1	CD1 Target Processor Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3E	CD1	CD1 Azimuth Alarm	0	Normal	A	1
					1	Alarm	C	1
28	PIO	3F	CD1	Data Channel 1	0	Not Selected	A	1
					1	Selected	A	1
28	PIO	40	CD1	Data Channel 2	0	Not Selected	A	1
					1	Selected	A	1
28	PIO	41	CD1	Data Channel 3	0	Not Selected	A	1
					1	Selected	A	1
28	PIO	42	CD1	Data Channel Local/Remote	0	Remote	A	1
					1	Local	A	1
28	PIO	43	CD1	Radar Message Alarm	0	Normal	A	1
					1	Alarm	C	1

TABLE A-10. AZIMUTH DATA UNIT (ADU) MEASUREMENT & DATA POINT CONFIGURATION (LU 29)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
29	AD	20	ADU	Not Used				
29	AD	21	ADU	ADU Ch 1 +5 Volt P.S.	x.x	5.0 V dc	A/C/D/E/F	1
29	AD	22	ADU	ADU Ch 1 +15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	AD	23	ADU	ADU Ch 1 -15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	AD	24	ADU	ADU Ch 2 +5 Volt P.S.	x.x	5.0 V dc	A/C/D/E/F	1
29	AD	25	ADU	ADU Ch 2 +15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	AD	26	ADU	ADU Ch 2 -15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	AD	27	ADU	ADU Ch 3 +5 Volt P.S.	x.x	5.0 V dc	A/C/D/E/F	1
29	AD	28	ADU	ADU Ch 3 +15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	AD	29	ADU	ADU Ch 3 -15 Volt P.S.	xx.x	15.0 V dc	A/C/D/E/F	1
29	PIO	2A	ADU	ADU Ch 1	0	Not Selected	A	1
					1	Selected	A	1
29	PIO	2B	ADU	ADU Ch 2	0	Not Selected	A	1
					1	Selected	A	1
29	PIO	2C	ADU	ADU Low Oil	0	Normal	A	1
					1	Alarm	C	1
29	PIO	2D	ADU	ADU Motor A	0	Normal	A	1
					1	Alarm	C	1
29	PIO	2E	ADU	ADU Motor B	0	Normal	A	1
					1	Alarm	C	1
29	PIO	2F	ADU	ADU Ch 1 Late ARP	0	Normal	A	1
					1	Alarm	C	1
29	PIO	30	ADU	ADU Ch 1 ACP Spacing	0	Normal	A	1
					1	Alarm	C	1
29	PIO	31	ADU	ADU Ch 2 Late ARP	0	Normal	A	1
					1	Alarm	C	1
29	PIO	32	ADU	ADU Ch 2 ACP Spacing	0	Normal	A	1
					1	Alarm	C	1

TABLE A-11. ATCBI SWITCHING (ASU) UNIT MEASUREMENT & DATA POINT CONFIGURATION (LU 2A)

LU	TASK	ID	UNIT	MEASUREMENT DESCRIPTION	VALUE	CONDITION	STATUS	SCALE
2A	PIO	20	ASU	Not Used				
2A	PIO	21	ASU	Trigger Generator #1	0	Not Selected	A	1
					1	Selected	A	1
2A	PIO	22	ASU	Trigger Generator #2	0	Not Selected	A	1
					1	Selected	A	1
2A	PIO	23	ASU	ASU Status	0	Normal	A	1
					1	Alarm	C	1

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APPENDIX B

1.1 **Local-MDT**. The Local-MDT program used in the ATCBI-5 RMS is similar to that used in the ATCBI-5 Beacon-Only Site RMS. Some of the tables have to be changed to accommodate the differences in some voltage readings or data point names.

1.2 **Local-MDT Review**. The Local-MDT program is the only human interface with the RMS while the electronic technician is at the site. All data points and commands that can be observed or issued from the MPS, or a remote MDT monitoring point, can be issued from the Local-MDT terminal. The one command that can not be issued from the Local-MDT is the remote RMS reset (resets the RMS's CPU). This command can be accomplished manually by the technician on site.

1.2.1 **Printing**. A screen may be printed at any time by pressing P. Local-MDT automatically sends a form-feed character, and prints the current date and time at the top of the page, followed by the screen data.

1.2.1.1 **Screen Types**. Most Local-MDT screens fall under one of four types: Menu, Status, Remote Control, and Threshold. A brief description of the operational functions of each screen types are described below.

1.2.1.1.1 **Menu Screens**. The first screen Local-MDT displays after loading is the Main Menu, which is typical of all menu screens in Local-MDT. A menu screen allows the user to select one of several paths for Local-MDT to take during various points of the program's progression. In some cases, a menu screen may even branch to another menu screen. The UP-ARROW and DOWN-ARROW keys on the numeric keypad are used to move the intensified line or selection bar to the desired location, and the carriage return is used to execute the selected function. A menu screen is exited by pressing the <ESC> key, with the exception of the Main Menu which uses function key F10 to exit to DOS.

1.2.1.1.2 **Status Screens**. A status screen continuously displays RMS parameters and alarm status information. The RMS is interrogated at regular intervals for fresh data, which is immediately displayed on the screen. Most status screens have only one page, but some may have two or more. Directions on the screen will indicate if another page of information is available. If so, it is activated by pressing the carriage return. Some status screens may have remote control capabilities associated with them, and directions at the bottom of the screen will indicate so if they do. The remote control screen is activated by pressing function key F1. A status screen is exited by pressing <ESC>.

1.2.1.1.3 **Remote Control Screens**. A remote control screen is similar to a menu screen, but rather than branching to another part of the program upon pressing RETURN on a selection, the selected command is sent from the MDT to the RMS. If the user has not logged on to the system, access to the remote control screen will be denied. If the MDT cannot determine log on status because the RMS is timing out, access will be allowed for testing purposes. If the MDT determines that the COMMAND ENABLE SWITCH is not in the ON position, the condition will be reported and access to the remote control screen will be denied. Remote control screens are exited by pressing <ESC>.

1.2.1.1.4 Threshold Screens. A threshold screen displays the alarm threshold values for selected RMS data points. In some cases, it also displays analog transducer scaling and offset values. The user can employ the cursor keys to move to a specific value, and overtype it with a new value. The new value is not sent to the RMS until the carriage return is pressed. If the user waits for a period of time exceeding the User Response Time from the time a numeric key is pressed to the time carriage return is pressed, Local-MDT will restore the original value to the screen. After the new value is sent to the RMS, the RMS is interrogated for the same value, which is subsequently written to the screen. This allows the user to determine if the new value was actually accepted by the RMS.

1.2.1.1.5 History Data Screen. The History Data Screen requests data from the RMS History table. The data is in its raw form and is to be used by the technician for on-site equipment diagnostic purposes.

1.2.2 ATCBI-5 RMS Screens. The ATCBI-5 RMS screens are similar to that used in the ATCBI-5 Beacon-Only Site RMS.

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APPENDIX C

1.1 ABBREVIATIONS AND ACRONYMS

ACP - Azimuth Change Pulse.

AD - Analog-to-Digital

ADU - Azimuth Data Unit.

ARO - Asynchronous Response Opportunity

ARP - Azimuth Reference Pulse.

ARSR-4 - Air Route Surveillance Radar, Model 4.

ARTCC - Air Route Traffic Control Center.

ATCBI-4 - Air Traffic Control Beacon Interrogator, Version 4.

ATCBI-5 - Air Traffic Control Beacon Interrogator, Version 5.

AZ - Azimuth

BCN - Beacon.

DISC - Disconnect

Downline Load - Transferring instructions from one computer to another.

DT-712 - 64-128 channel analog to digital converter.

DTE - Data Terminal Equipment.

EEPROM - Electronic Erasable Programmable Read Only Memory.

EPROM - Erasable Programmable Read Only Memory.

FCC - Federal Communications Commission.

FCS - Frame Check Sequence

FRMR - Frame Reject.

GPIB - General Purpose Interface Bus.

HDLC - High Speed Data Link Control. A bit oriented network protocol.

HV - High Voltage.

I - Information Frame

IEEE - Institute of Electrical & Electronic Engineers.

IEEE 488 - 1978 Parallel Interface Standard.

I/O - Input/output.

IRMM - Interim Remote Maintenance Monitor

iSBC - Trademark of Intel Corporation.

iSBX - Trademark of Intel Corporation.

ISM - Integral System Monitor

Intel - Intel Corporation

Khz - 1,000 hertz or 1000 cycles per second.

LU - Logical Unit.

LUID - Logical Unit Identification Data point

MPS - Maintenance Processor Subsystem.

MCS - Monitor and Control Software

MDS - Minimum Discernible Signal.

MDT - Maintenance Display Terminal.

MPS - Maintenance processor system

MPU - Maintenance Processor Unit.

MSB - Most Significant Bit

MSG - Message

Multibus - Trademark of Intel Corporation.

Multimodule - Trademark of Intel Corporation.

NRZI - Non Return to Zero Inverted. A method of clocking computer data transmission.

PC - Personal Computer.

PIO - Parallel Input output.

PS - Power Supply

RAM - Randem Access Memory.

REJ - Reject

RB - Readback.

RL - Run Length

RML - Radar Microwave Link.

RMMS - Remote Maintenance Monitoring System

RMS - Remote Monitoring Subsystem.

RMSC - Remote Monitoring System Concentrator.

RMX-86 - Trademark of Intel Corporation. Refers to the operating system.

RNR - Receive Not Ready

ROM - Read Only Memory.

RR - Receive Ready

RS 232 - Serial interface standard.

RS 429 - Serial interface standard.

RSM - Remote System Monitor

RTN - Return To Normal

S - Supervisory Format

SDLC - Synchronous Data Link Control.

SDR - Site Data Report

SNRM - Set Normal Response Mode

STC - Sensitivity Time Control

TTG - Test Target Generator

TTL - Transistor-Transistor Logic. Between 0 and 5 volts.

Telecommunication - Data communication over telephone lines.

Terminal - Interface between the central processor and the radar site.

Transponder - Aircraft transmitter-receiver used with the beacon interogator.

U - Unnumbered Format

UA - Unnumbered Acknowledgement

VSWR - Voltage Standing Wave Ratio

APPENDIX D

1.1 Monitor and Control Software (MCS) Screens

Interim Monitor and Control Software (IMCS) or Monitor and Control Software (MCS) screens are presented to a Maintenance Data Terminal (MDT) connected to the Maintenance Processor Subsystem (MPS). These MDTs will usually be located in the General National Airspace System (GNAS) and Air Route Traffic Control Center (ARTCC) Maintenance Control Centers (GMCCs and AMCCs). The (I)MCS screens can also be accessed from workcenter locations that have access to MMS.

The "Constant Monitor Screen" functions as a main menu to the (I)MCS system. This screen remains on display at all times that no alarms are being acknowledged or no maintenance activities are taking place through the (I)MCS system. (I)MCS is designed to return to the constant monitor screen after a period of inactivity.

The remaining screens are used to present site directory, security analysis, status and alarm information. By looking at the screen title, the page number m / n, and the available functions from the bottom of the current and previous screens, you should be able to determine how each screen is accessed and what type of information is presented.